Túuši Wána Design Project

Touchet River - Mile 14 – 17

Preliminary Basis of Design Report

November 2022

Túuši Wána Design Project

Touchet River - Mile 14 – 17

Preliminary Basis of Design Report

SUBMITTED TO

Confederated Tribes of the Umatilla Indian Reservation
DNR Fisheries Program
46411 Timine Way
Pendleton, OR 97081

PREPARED BY

Inter-Fluve
501 Portway Ave
Hood River, OR 97031

November 2022

Table of Contents

List of Figures

List of Tables

1. Preface

The Túuši Wána Design Project (Project) area is located along the Touchet River in Walla Walla County Washington (Figure 1). The project is located at approximately River Mile (RM) 14 to 17. The project is entirely on privately owned land. It is currently known if the Washington Department of Natural Resources (WADNR) will assert that the Touchet River, within the project extent, is part of the State-Owned Aquatic Lands (SOAL). Habitat conditions for juvenile and adult salmonids have been impaired within the project area by riparian clearing, regional agriculture, and sediment deposition. This report is being delivered as part of the preliminary design package and is formatted to meet the BPA HIPIV General Project Data Summary Requirements (GPDSR) Basis of Design Report guidelines.

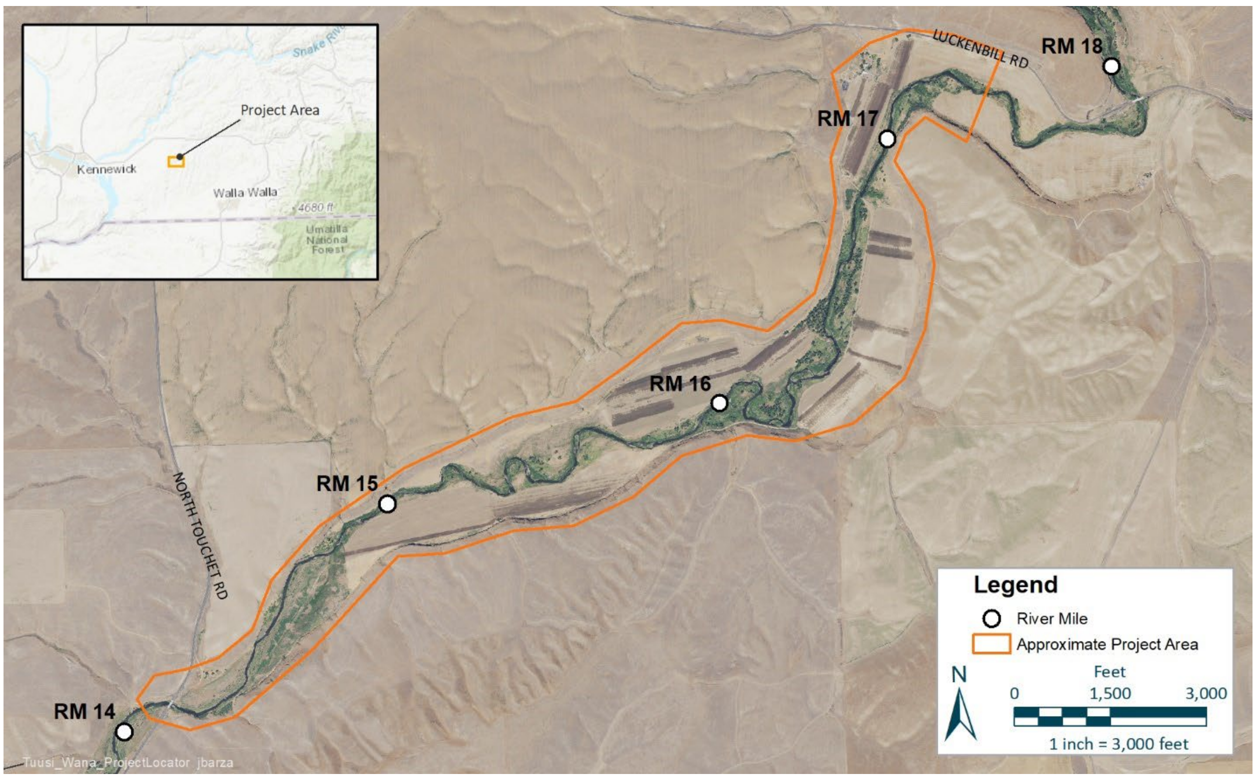


Figure 1. Túuši Wána Design project area.

This project is intended to improve conditions of the project area so they more closely resemble target conditions outlined in the Confederated Tribes of the Umatilla Indian Reservation's (CTUIR) "River Vision" (Jones et al. 2008). In line with this River Vision, the project elements described here are intended to restore and reclaim the processes needed to support aquatic First Foods. These processes include: improving degraded hydrology, reclaiming geomorphic function, providing habitat connectivity, supporting a diverse riverine biotic community, and restoring riparian vegetation diversity and density (Jones et al. 2008).

Driven by this larger River Vision, the goals of this project are focused on habitat for two species and the general recovery of more natural river valley and riparian processes. The project goals include:

- Improve holding, overwintering, and migration refugia habitat throughout reach to support upstream migrating adult salmonids
- Improve high-flow refugia and rearing habitat for juvenile salmonids utilizing lower reaches of Touchet River for rearing or during outmigration
- Recovery of more natural river valley geomorphic processes through the installation of a large number of large wood structures (LWS) intended to initiate and maintain in the mid-term increased hydraulic variability leading to a more complex channel planform (e.g., split flows) and depth variations (e.g., pools and bars)
- Recovery of more natural riparian processes through the installation of a large quantity of live cuttings and other plantings intended to initiate and maintain in the long-term a more extensive and diverse forested valley bottom

1.1 NAME AND TITLES OF SPONSOR, FIRMS, AND INDIVIDUALS RESPONSIBLE FOR DESIGN.

Restoration designs developed for this project are sponsored by The Confederated Tribes of the Umatilla Indian Reservation (CTUIR). Inter-Fluve has been hired as the engineering design firm. Jerry Middel (Rainwater Wildlife Area Project Lead and Upper Touchet Habitat Specialist; CTUIR), Emily Alcott, CE, PWS (Fluvial Geomorphologist/Ecologist; Inter-Fluve) and John Gaffney, PE (Water Resources Engineer; Inter-Fluve) are responsible for the design.

1.2 LIST OF PROJECT ELEMENTS THAT HAVE BEEN DESIGNED BY A LICENSED PROFESSIONAL ENGINEER.

John Gaffney (PE, Washington State No. 51075) is the licensed engineer of record for this project. Project elements include the following with BPA HIP IV activity and risk category included:

Table 1. Activity categories included in the project.

Work Element	HIP IV Category	HIP IV Risk Level
Improve secondary channel and wetland habitats	2a	Med-high
Set-back or removal of existing berms, dikes, and levees	2b	Med-high
Install habitat-forming natural material instream structures	2d	Low - High
Riparian vegetation planting	2e	Low

1.3 IDENTIFICATION AND DESCRIPTION OF RISK TO INFRASTRUCTURE OR EXISTING RESOURCES.

Existing infrastructure in the vicinity of the project area includes the Luckenbill Road Bridge 0.8 miles upstream of the project easement, the Touchet North Road Bridge 0.7 miles downstream of the project area, residential & agricultural buildings, overhead powerlines & utility poles in the floodplain, tilled and untilled agricultural fields on the floodplain, and irrigation pump stations along the channel. Analysis of design components includes comparison of changes to water surface elevations and velocities between existing and proposed conditions. This analysis included use of a two-dimensional hydraulic modeling to evaluate potential risks to these resources. The stability of large wood structures will be further evaluated relative to these risks as design progresses (see Section 3.6).

1.4 EXPLANATION AND BACKGROUND ON FISHERIES USE (BY LIFE STATE – PERIOD) AND LIMITING FACTORS ADDRESSED BY PROJECT.

The Touchet River within the project area is used by threatened Mid-Columbia steelhead trout (*Oncorhynchus mykiss)*, Mid-Columbia spring Chinook salmon (*O. tshawytscha*), and possibly Columbia River bull trout (*Salvelinus confluentus*). Little empirical data is available on fish use of the Touchet River within the project area; it is assumed to be primarily a migration corridor for adults migrating upstream to spawning areas and for juveniles migrating downstream to the ocean. Resident fish, including native redband and rainbow trout, as well as non-native smallmouth and largemouth bass, are also assumed to use the project area throughout the entire year. Timing of life stage use by species for the greater Touchet River subbasin is discussed in subsequent subsections and an overview is presented in Figure 2. The timing and type of use by each of these species informs both the type of project elements proposed and dictates the frequency and duration of project element connectivity. Of note, for discussions below, emergence timing refers to fry emergence from gravel and not alevin hatching (Quinn 2005, Moyle et al. 2002, Moyle et al. 2002b).

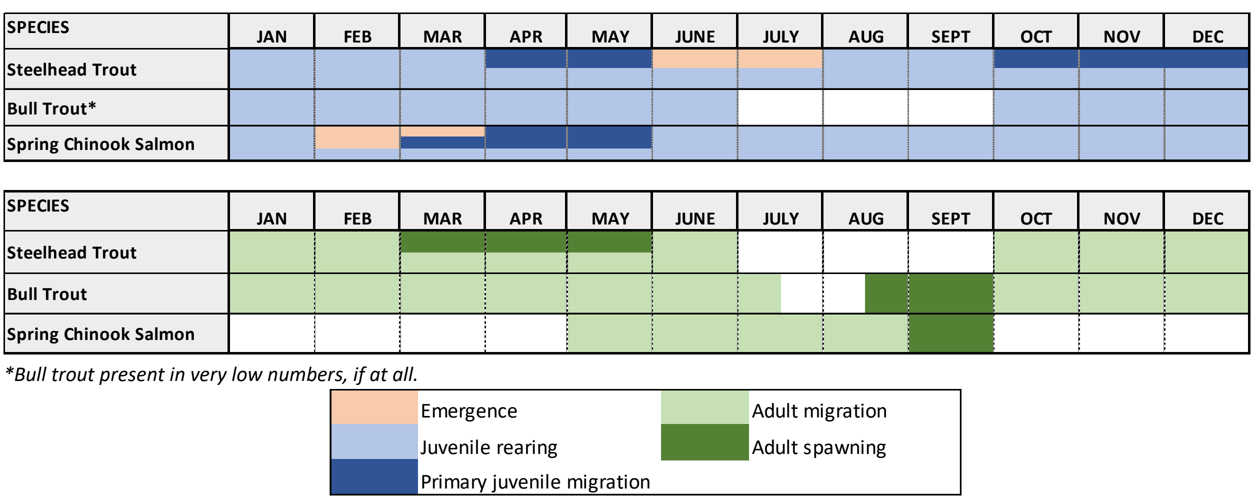


Figure 2. ESA listed fish use timing in the project area. From CTUIR 2014 and Steve Martin, personal communication.

1.4.1 Steelhead

Adult steelhead may start to move into the Touchet watershed as early as September if flows and water temperatures are sufficient and migration continues through June. Adult steelhead may also hold in the Columbia and Lower Walla Walla Rivers in the fall, migrating up into the tributaries near spawning areas in January. Peak upriver migration occurs in March and April right before spawning (Figure 3). Spawning and juvenile rearing occur mostly in the upper portions of the watershed above the project area.

The majority of steelhead fry emerge between June and July, right as the hydrograph typically drops to near base flow and water temperatures rise (Moyle et al. 2002, Quinn 2005). Age-0 juveniles spend their first year primarily in shallow riffle habitats, feeding on invertebrates and utilizing overhanging riparian vegetation and undercut banks for cover (Moyle et al. 2002, USFWS 1995). Older juveniles prefer faster moving water including deep pools and runs (USFWS 1995). Juvenile outmigration is bimodal, with fall outmigration of small (likely Age-0) juveniles in October – December and spring outmigration of transitional and smolt-sized fish in April and May (CTUIR 2014). Juveniles outmigrating in the fall may be leaving the drainage or looking for rearing/overwintering areas in the lower Touchet or Walla Walla Rivers. Juveniles outmigrate between ages zero and three, though some may hold over and display a resident life history form in reaches upstream of the project area (Mendel et al. 2014).

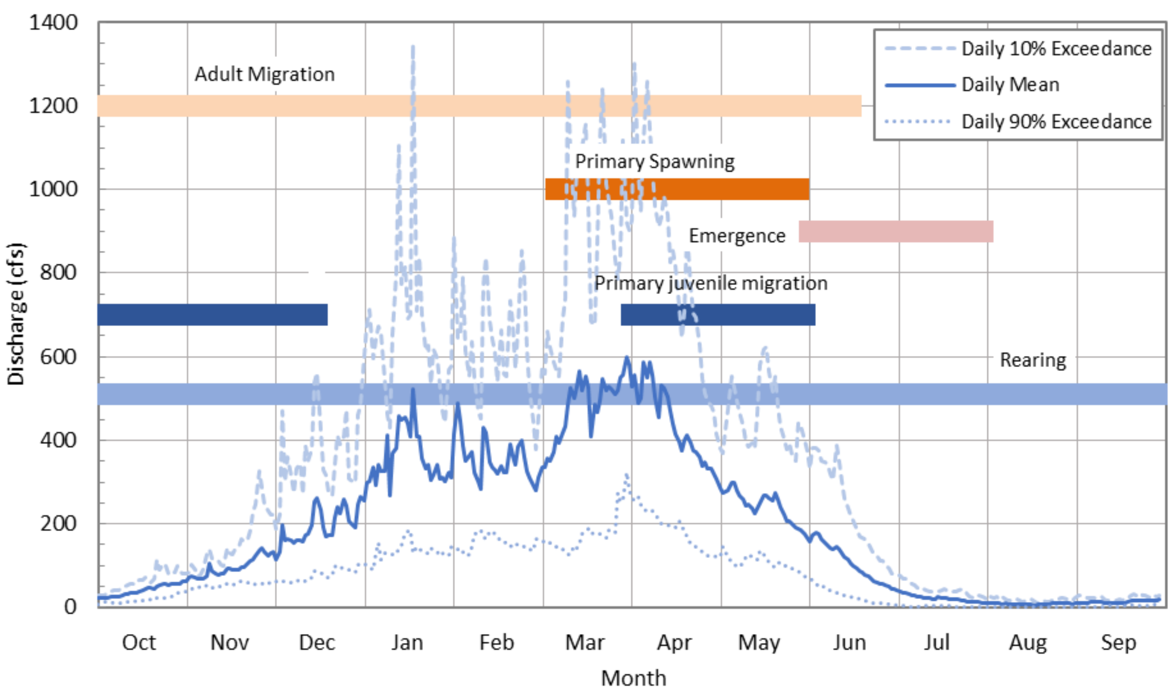


Figure 3. Steelhead (Oncorhynchus mykiss) life history timing in the Touchet River and Walla Walla River watersheds overlaid on discharge in the Túuši Wána project area. Discharge data is adjusted from the WDOE Cummins Rd gage (~RM 3, period of record Water Year 2003-2021) using a direct basin area correction. Fish use timing is approximate and reflects typical life history stages (WDFW 2014, Steve Martin 2016) for fish utilizing the Touchet River. Upstream adult and downstream juvenile migration are the primary life history stages assumed to be present in the Túuši Wána project area.

1.4.2 Spring Chinook

Native spring Chinook were considered extirpated from the greater Walla Walla River subbasin in the mid-20th century, but recent reintroduction efforts have re-established a naturally spawning population (CTUIR 2019).

Spring Chinook return to the Touchet River between April and July, though some late-returning fish may be delayed due to high water temperatures and finish their final upstream migration through the Touchet in September as temperatures drop (Figure 4). Peak return coincides with a strong decline in the hydrograph and a simultaneous increase in water temperatures, forcing Chinook to migrate further upstream to avoid stranding and/or potentially lethal temperatures, particularly in drought years (Mendel et al. 2014).

The majority of spawning occurs in September, with fry emerging in February and March. Emergence coincides with the rising hydrograph, forcing juveniles to seek out backwater or margin areas with lower velocities, dense cover, and abundant food (Quinn 2005). As they increase in size, juveniles begin to select for deeper and faster moving water, particularly areas with overhanging cover (Moyle et al 2002b). These areas provide more holding and feeding habitat area for the larger juveniles to occupy. Mid-Columbia spring Chinook express a stream-type life history, meaning they rear in freshwater for at least one year before outmigrating in the spring as yearlings.

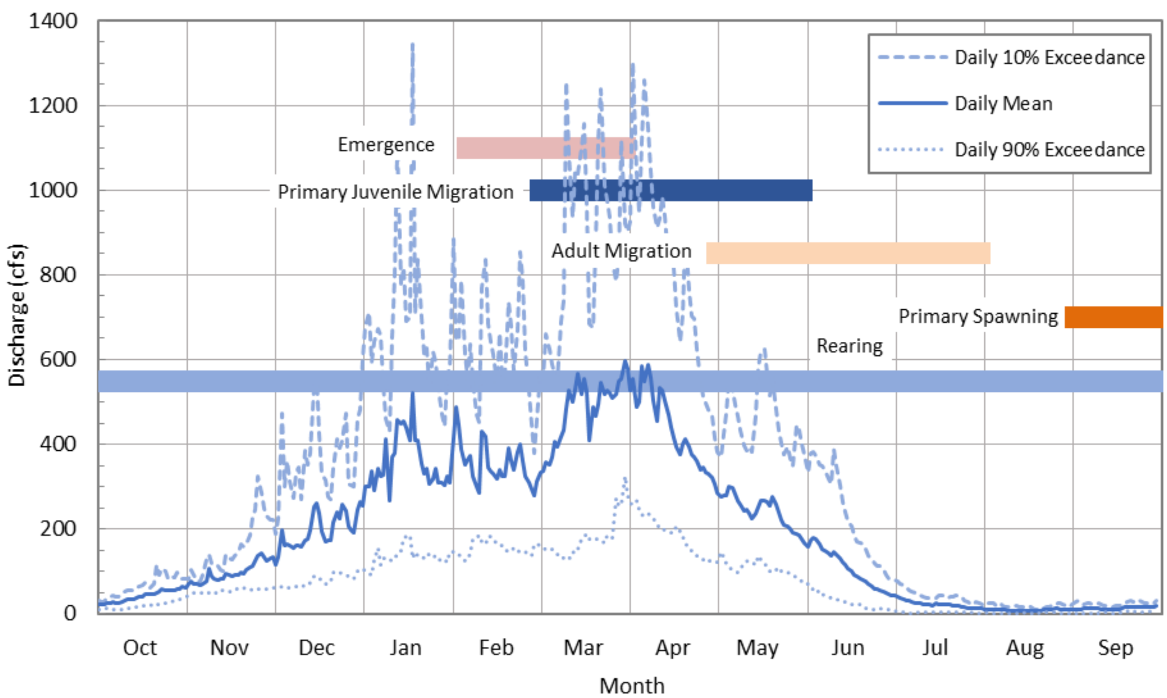


Figure 4. Chinook (Oncorhynchus tshawytscha life history timing in the Touchet River and Walla Walla River watersheds overlaid on discharge in the Túuši Wána project area. Discharge data is adjusted from the WDOE Cummins Rd gage (~RM 3, period of record Water Year 2003-2021) using a direct basin area correction. Fish use timing is approximate and reflects typical life history stages (WDFW 2014, Steve Martin 2016) for fish utilizing the Touchet River. Upstream adult and downstream juvenile migration are the primary life history stages assumed to be present in the Túuši Wána project area.

1.4.3 Bull Trout

Bull trout in the Touchet basin overwinter downstream of Dayton and return to headwater areas of the drainage from March through July (Figure 5). Bull trout hold over in these areas until spawning in September and October (Mendel et al. 2014). Juvenile rearing primarily occurs in the cooler headwaters, though they may rear in other areas in the fall through spring when temperatures are cooler (S. Martin personal communication, 2016). Bull trout may use the project area in small numbers as a migration corridor between overwintering/foraging and spawning areas (CTUIR 2019).

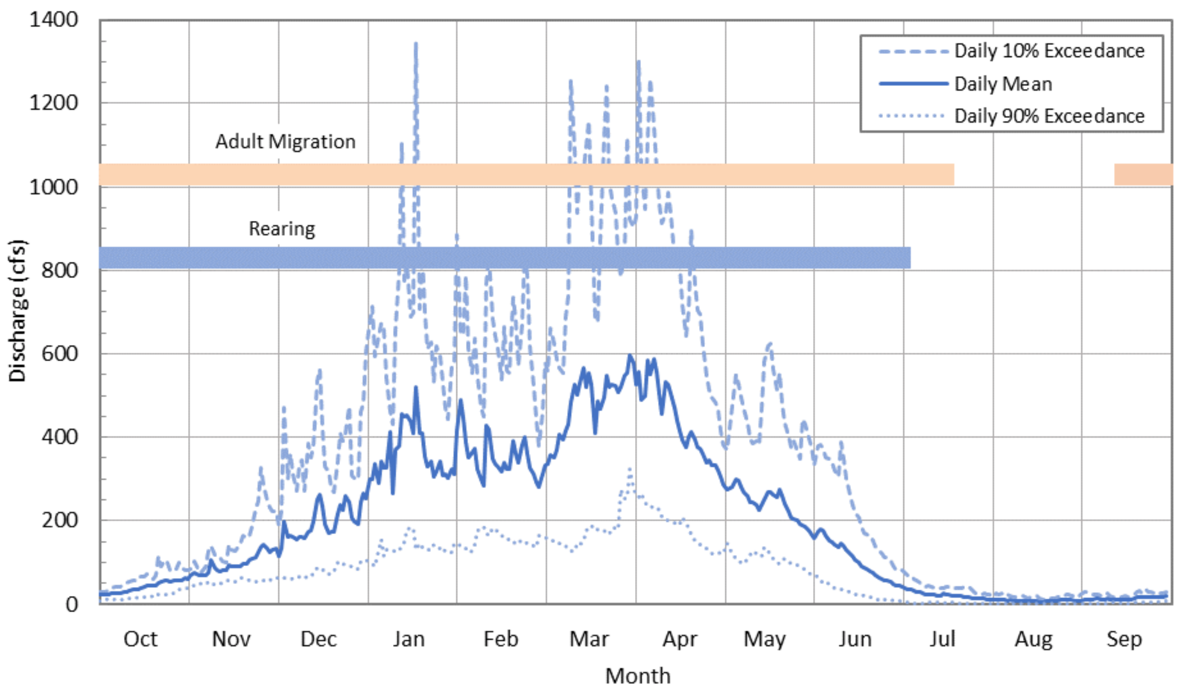


Figure 5. Bull trout (Salvelinus confluentus) life history timing in the Touchet River and Walla Walla River watersheds overlaid on the discharge in the Túuši Wána project area. Discharge data is adjusted from the WDOE Cummins Rd gage (~RM 3, period of record Water Year 2003-2021) using a direct basin area correction. Fish use timing is approximate and reflects typical life history stages (WDFW 2014, Steve Martin 2016) for fish utilizing the Touchet River. Upstream adult and downstream juvenile migration are the primary life history stages assumed to be present in the Túuši Wána project area.

1.4.4 Limiting factors and water quality

This project is designed to address a number of limiting factors, as identified by CTUIR, for target species in the project area, including a lack of in-channel characteristics, limited passage/entrainment, and reclaiming riparian and floodplain function and connectivity. Project objectives are intended to improve these primary limiting factors and are presented in Table 2.

In addition to these limiting factors, the Touchet River currently has a category 4A water quality listing for temperature (Washington Department of Ecology Listing #23779), and is part of the Walla Walla River Subbasin TMDL for pH, dissolved oxygen, and temperature.

Table 2. Limiting factors and project objectives.

Primary limiting factors	Project objectives
In-channel characteristics	Increase channel complexity, with morphology closer to historical function and form
	Increase stream velocity diversity at a range of flows
	Improve sediment sorting and routing
	Improve in-stream thermal diversity
	Increase quantity and quality of habitat diversity, especially LWD and pools
Passage/entrainment	Increase area suitable for juvenile rearing
Riparian/floodplain	Increase floodplain connectivity and frequency of inundation
	Increase riparian function with site-appropriate native vegetation

1.5 LIST OF PRIMARY PROJECT FEATURES INCLUDING CONSTRUCTED OR NATURAL ELEMENTS.

Primary project features include main channel wood structures, floodplain wood structures, revegetation, and set-back or removal of existing berms, dikes, and levees (riprap removal). A more detailed description of each is provided below. Main channel reconstruction is not included in this project.

- *Main channel wood structures*. Large wood structures, including the Apex and Bank-Buried Large Wood Structures, will be used as a proxy to mimic the structure provided by historical mature cottonwood trees. These structures will be approximately 20 pieces of wood, ballasted through bank burial and vertical logs. The intent of these is to drive lateral migration and act as 'hard' points for the channel to migrate around and respond to. This is intended to jump start the development of riparian vegetation "nursery sites," primarily downstream point and mid-channel bars. These will be paired with live poles and live cuttings that will be installed down to the water level.
- *Floodplain wood structures*. Floodplain wood structures with accompanying live plantings, which includes Floodplain Large Wood Structures and Off-channel post-assisted log structures, will be placed in areas where higher flows have and are expected to access the floodplain. These will act as 'hard' points for the channel to migrate around and respond to. These will be comprised of five to nine pieces of large wood simulating the shape of an apex log structure or the structural function of a beaver dam, with live poles, live willow bundles, and cuttings dug down into the water level and interwoven into the structure and downstream velocity shadow.
- *Revegetation*. Revegetation will focus on the removal of non-native plants and subsequent installation of live willows and cottonwoods in select pods and/or trenches within the conservation easement. Poles, cuttings, and/or small whole trees will be installed so their "feet" can access the summer's lowest water table. It is anticipated that the revegetation effort will phased over multiple years to not remove too much of the riparian structure at one time, which currently is provided by False Indigo, and realize the benefits provided by installed large wood structures (e.g., planting a bar after it forms downstream following a high flow event).
- *Set-back or removal of existing berms, dikes, and levees.* Existing riprap and bank armoring will be removed throughout the project area. This will allow for bank erosion and remobilization of floodplain sediments to return to the project reach.

1.6 DESCRIPTION OF PERFORMANCE/SUSTAINABILITY CRITERIA FOR PROJECT ELEMENTS AND ASSESSMENT OF RISK OF FAILURE TO PERFORM, POTENTIAL CONSEQUENCES AND COMPENSATING ANALYSIS TO REDUCE UNCERTAINTY.

Design criteria provide the overall guideposts for the project and are developed so that project components address key constraints and objectives and remain consistent with CTUIR's River Vision. The design criteria are divided into five categories: habitat, geomorphology/hydrology/ecology, engineering and risk, and construction impacts. The consequences associated with failure to perform in the criteria categories vary depending on the severity of failure and the specific criteria. A discussion of these consequences follows each category.

1.6.1 Habitat

- Improve holding, overwintering, and migration refugia habitat throughout reach to support upstream migrating adult salmonids.
- Improve high-flow refugia and rearing habitat for juvenile salmonids utilizing lower reaches of Touchet River for rearing or during outmigration

The following section describes each design feature, how it meets the habitat design criteria, and how it will improve salmon habitat according to the limiting factors and project objectives. A summary of each element and it's intended benefits is included in Table 3.

Riprap removal

Riprap is currently limiting natural channel processes along river right in multiple locations. Its removal will reduce main channel velocities and bed shear stress (allowing for the recovery of more gravel dominated channel bed composition), allow for floodplain activation at the 2-year recurrence interval, and allow for more natural channel migration in the future.

Main channel large wood structures (Bank-buried large wood and Apex structures)

Bank-buried large wood structures are intended to provide cover at a range of flows. They are expected to drive lateral channel migration, provide hydraulic complexity, promote scour, and rack wood as it is transported downstream. Further, large wood can mimic the structure of larger riparian trees that historically provided 'hard' points to drive lateral channel migration. This structure can serve as a temporary 'stopgap' while riparian vegetation to grow to a sufficient size to serve this function again. areas where comparable structure provided by regrowing those trees in decades away. They will be placed in areas where large-wood loading would have historically occurred and/or where cottonwood stands would likely have been present. These structures will be at least partially wetted year-round. These structures included an excavated scour pool under the rootwads to provide holding habitat for adult salmonids and rearing habitat for juveniles. The pools will be inundated year-round, and more logs will become inundated as stage increases. The pools will be inundated year-round, and more logs will become inundated as stage increases. All large wood structures installed will be packed with slash to provide small interstitial spaces for juvenile refuge and planted with live stakes to promote the regeneration of the large wood cycle.

Apex large wood structures are intended to split flows at moderate to high flows. These structures partially obstruct the main channel, encouraging flow to split around the structure to drive bank erosion and inundate off-channel areas more frequently than they otherwise would be. During high flows, flow will split and gravel will be deposited in the velocity shadow created immediately downstream of the structure footprint. Many of these structures will be engaged at lower flows, and will nearly all be engaged during channel forming flows (e.g., 2-year flood events). These structures include a scour pool at the upstream end that will be inundated year-round. This will provide margin habitat for migrating juvenile salmonids. Apex structures provide some immediate habitat benefit within the placed wood and scour pool; however, their main benefit is providing split-flow conditions which increases bank erosion and subsequent downstream point bar deposition and frequency of off-channel habitat activation.

Risk of Failure to Perform

See Risk of Failure to Perform in section 1.6.2.

Floodplain structure placement

After juvenile spring Chinook salmonids emerge from the gravel, they are swept downstream and into backwater areas with low water velocities and abundant food resources (Moyle 2002b). Floodplain enhancement has been designed to provide habitat at this vulnerable life stage as fish migrate through the project reach, in addition to providing habitat for all target salmonid species, in the Touchet River. The proposed enhancements will provide suitable off-channel habitat for these fish, and will include a mix of large wood and slash to provide cover and refuge at flows that inundate the floodplain (typically the 5-year and above, see Table 4). Slash, cottonwood poles, and habitat large wood structures will combine to provide a range of cover types and stem densities in off-channel areas. Slash and cover provide fish security from predation, increase habitat suitability, and increase carrying capacity (Bjornn and Reiser 1991).

Risk of Failure to Perform

See Risk of Failure to Perform in section 1.6.2.

Table 3. Limiting factors, objectives, and proposed habitat features.

		Channel structure placement		**Floodplain structure placement**		**Riprap Removal**	**Riparian/Floodplain Area**
Primary limiting factor	**Project objectives**	Bank margin large wood structure	Apex large wood structure	Floodplain Large Wood Structure	Off-channel post-assisted log structure	Multiple Locations Along Channel	Revegetation
In-channel characteristics	Increase channel complexity	X	X	X	X	X	
	Increase stream velocity diversity at a range of flows	X	X	X	X	X	
	Improve sediment sorting and routing	X	X		X	X	
	Increase instream thermal diversity						X
	Increase quantity and quality of habitat diversity, esp. LWS and pools	X	X	X	X	X	
Passage/ entrainment	Increase locations suitable for adult spawning	X	X				
	Increase area suitable for juvenile rearing	X	X	X	X		
Riparian/ floodplain	Increase floodplain connectivity	X	X		X		
	Increase riparian function	X	X	X	X		X

1.6.2 Geomorphology, Hydrology, & Ecology

- Design projects that are consistent with the best available science regarding current and reasonably foreseeable hydrologic, climactic, sediment, and large wood regimes.
- Allow for naturally dynamic and deformable processes to operate, within the constraints imposed by existing landownership, infrastructure, and safety considerations
- Increase the frequency, duration, and magnitude of floodplain inundation in areas away from public/private infrastructure or other areas identified by land owners
- Restore more naturalized rates of channel migration processes in areas away from public/private infrastructure or other areas identified by land owners
- Increase the potential for future large wood recruitment and retention in areas away from public/private infrastructure or other areas identified by land owners
- To the extent practicable, remove bank armoring that inhibits lateral channel migration rates
- Preserve select mature stands of mature vegetation to provide shading
- Replant riparian forests where feasible using native species to achieve a sustainable riparian forest density, structure, and species composition.

Risk of Failure to Perform

Failure to perform on the habitat and geomorphology/hydrology/ecology criteria are interrelated and their consequences could result in a moderate decrease in project benefit. These risks remain consistent with those risks faced by naturally-created floodplain surfaces, which historically were transient features on the landscape. To compensate for uncertainty and improve the chances that the project meets the design criteria, a range of actions are included in the design and it is anticipated that invasive species removal (principally the removal of False Indigo, which provides the majority existing bank structure) and revegetation efforts will be phased.

1.6.3 Engineering and Risk

- Do not increase flood inundation extents or depth surrounding public/private infrastructure or in areas other identified by land owners, unless compensating/mitigation measures are taken
- Do not increase erosion potential near public or private infrastructure or in other areas identified by land owners, unless compensating/mitigation measures are taken
- Provide stabilization of placed large woody material to withstand the 25-year peak flow, with a factor of safety commensurate with the risk to public safety and property damage

Risk of Failure to Perform

Failure to perform in the engineering and risk category may create a hazard to the public and increase the risk to private property and infrastructure. The consequences of failure to perform on the habitat geomorphology/hydrology project criteria need to be balanced against and viewed with regard to the consequences of failure related to public safety, health and welfare. These include hazards such as: floods, loss of property via. erosion, damage to property via. large wood structure destabilization, and other safety hazards that may develop as a result of project failure. This standard of engineering practice is established in the first canon of engineering ethics:

> "Engineers shall hold paramount the safety, health and welfare of the public and shall strive to comply with the principles of sustainable development in the performance of their professional duties. … Engineers should be committed to improving the environment by adherence to the principles of sustainable development so as to enhance the quality of life of the general public. " (ASCE 20017).

Therefore, the projects design has been approached with the objective of improving habitat (i.e. the environment) and restoring natural processes while holding paramount the safety, health and welfare of the public.

1.6.4 Construction Impacts

- Minimize impacts to fish during the construction process by reducing the need for dewatering and worksite isolation during construction
- Locate and configure construction access routes to use existing access where possible and to minimize impacts to existing mature riparian vegetation
- Work with onsite resources or plan floodplain alignments to take advantage of existing natural features where feasible (e.g. trees, low swales in landscape)
- Phase work so that the interrelated benefits of invasive species removal, large wood structural placement, and revegetation can realize their benefits without excessive inputs of sediment to the system

Risk of Failure to Perform

Failure to perform in the construction impacts category may result in excessive short-term degradation of the environment and potentially a direct loss of fish. Construction impacts are generally reduced through thoughtful design, clear and practical permit requirements, and best management practices. This project has been designed to incorporate each of these things. Additionally, the presence of the design engineer (or representative), the client's representative, and land owners during construction can help avoid unnecessary impacts by making adjustments to the design that preserve desirable features (e.g., trees and other native vegetation) without reducing the projects habitat benefit.

1.7 DESCRIPTION OF DISTURBANCE INCLUDING TIMING AND AREAL EXTENT AND POTENTIAL IMPACTS ASSOCIATED WITH IMPLEMENTATION OF EACH ELEMENT.

Areal extents of project elements are included on the Plans. Construction will take place during the permitted in-water work window, unless otherwise coordinated and approved in writing with appropriate regulatory agencies.

2. Resource Inventory and Evaluation

2.1 DESCRIPTION OF PAST AND PRESENT IMPACTS ON CHANNEL, RIPARIAN AND FLOODPLAIN CONDITIONS.

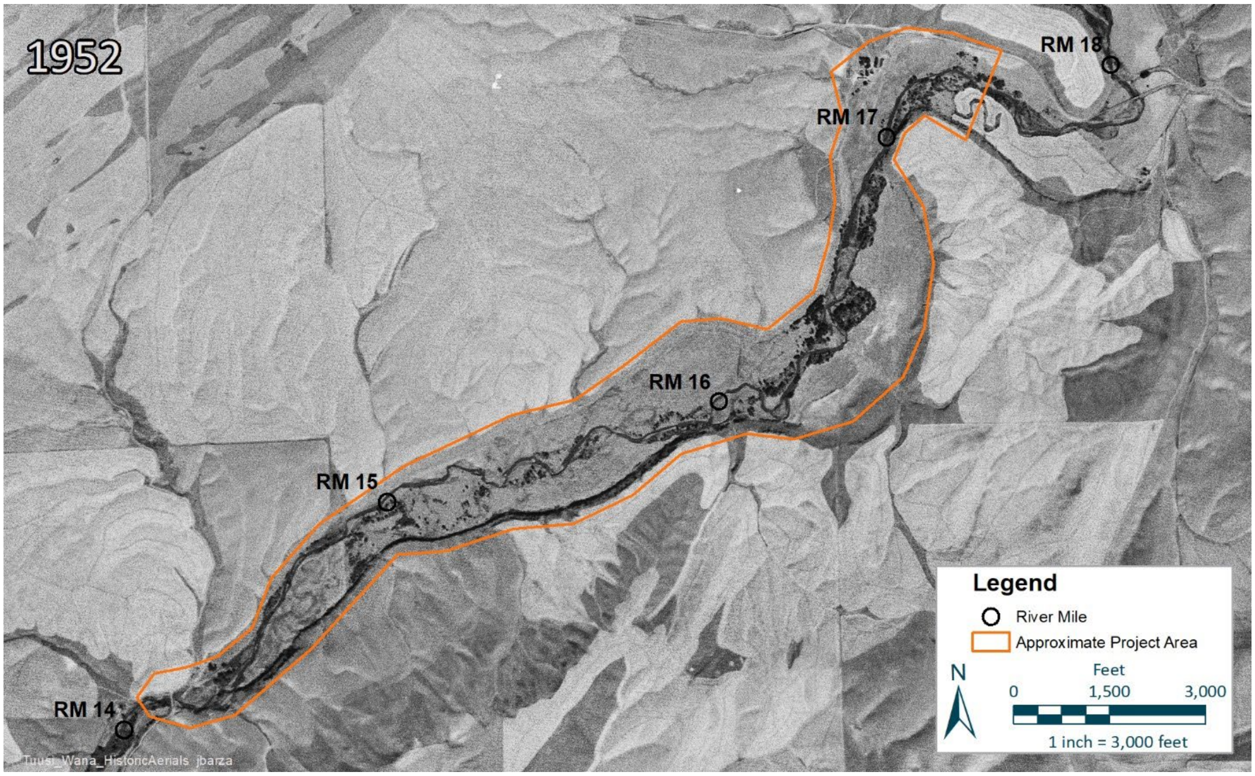
The project area has been negatively impacted by intensive riparian clearing, channelization, bank armoring, floodplain clearing, hillslope clearing, and levee construction. Riparian clearing occurred until at least 1996 and has resulted in a sparse and immature riparian community. Today, the riparian community can be classified as entirely absent or early to mid-seral stage. These smaller wood dimensions have resulted in moderated channel erosion rates.

Channelization, floodplain grading, and bank armoring appear to have been evident by 1952 and continued to accelerate in scope and scale through the 1970s. These actions are evident by meander scars and channels visible in the 1952 aerial disappearing by the 1964 aerial (Figure 7). These actions were likely both a desire to maximize land productive for agriculture and as a reaction to flooding in the 1960s and early 1970s, and have straightened the channel and reduced its ability to migrate within the floodplain as compared with historical conditions. The concentrated streamflow has combined with significant aggradation of the floodplain, driven primarily by hillslope erosion related to land clearing, leading to widespread channel disconnection from the floodplain (Figure 6) (USDA 1979, USGS 1998, USGS 1969). This has significantly reduced floodplain connectivity, contributed a high load of fine sediments, and reduced channel complexity.

Figure 6 Test pit dug at Tuusi Wana project area. Water-table was measured at 12 feet below existing ground, with alluvium measuring 8 to 10 feet below existing ground surface. The elevation of the alluvium and water table closely matches the alluvium and water table elevations at the river.

While the project area has been altered by floodplain aggradation, channelization, bank armoring, and riparian/floodplain clearing – it should be noted that natural flow regimes can also impact site conditions. Flood frequency analysis, and comparison with historical aerials, can provide an overview of when large-scale flood events have driven channel change and associated responses. While the nearby Touchet River gages have limited periods of record, the Walla Walla River has been used as a reference gage (Section 3.3.1) to gain a general sense for when large flow events likely occurred in the Touchet River. These recurrences are therefore very approximate and are only used here to scale interpretation of the below aerial photographs. Approximate 5-year events occurred in January 1969 and 1971, a 10-year event occurred in February 1996, and a near 50-year event occurred December 1964 (see Figure 14).

The 1952 aerial image shows farm fields along both sides of the river, with the Luckenbill Bridge already in place. The group of farm buildings and the associated farm house are already in place in the same location today. A sinuous planform of the apparent river channel is visible at the upstream end of the approximate project area (Figure 7, 1952 aerial), and is soon not visible due to apparent agricultural-related floodplain grading (Figure 7, 1964 aerial). Some riparian clearing has occurred by this time, and no in-channel wood is visible. Further, multiple sinuous swales and off-channel features that are visible in the 1952 aerial and are lined with apparent cottonwood trees, appear cleared and graded by 1964 and 1976. The riparian area along both banks was largely cleared between 1964 and 1976. Large areas of scour or grading are located along the floodplain, and nearly all trees are cleared by the 1976 aerial along the floodplain and both banks. Beginning in the 1996 aerial, aerial images show a return of trees and shrubs in several areas along the channel.



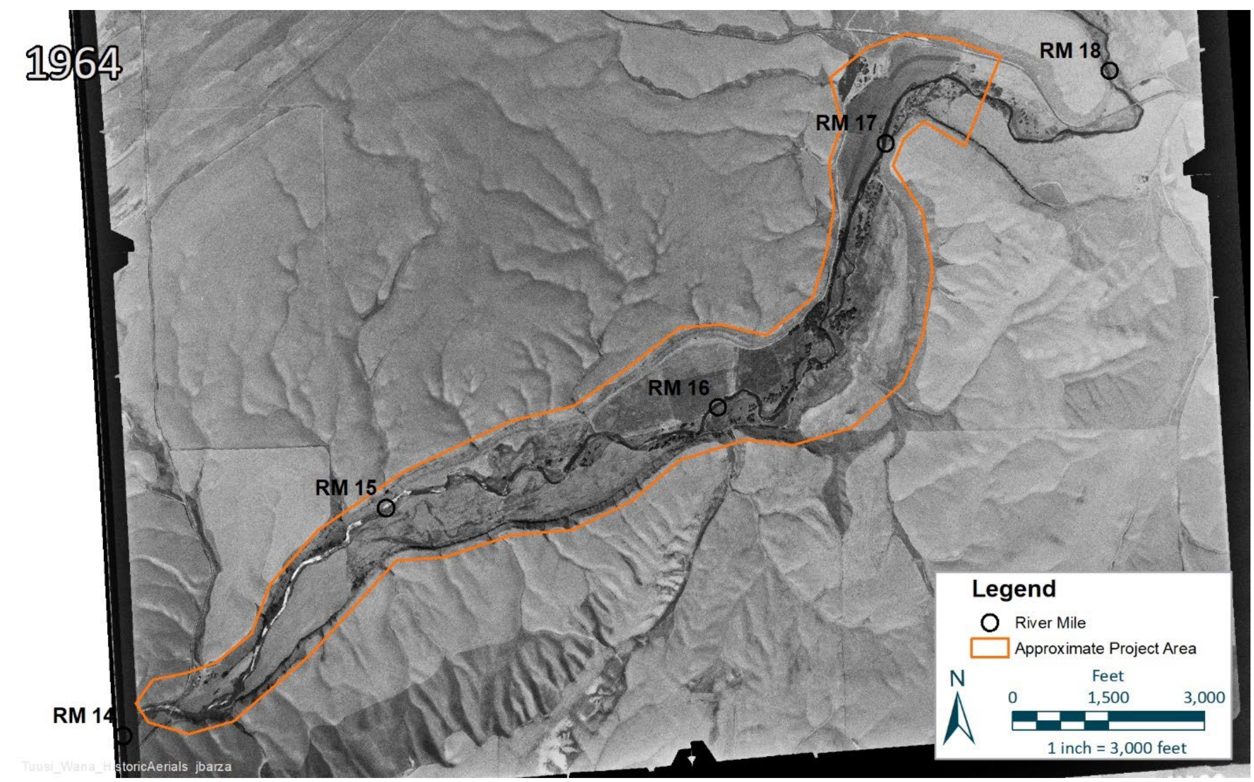


Figure 7. Aerial imagery from 1952 and 1964.

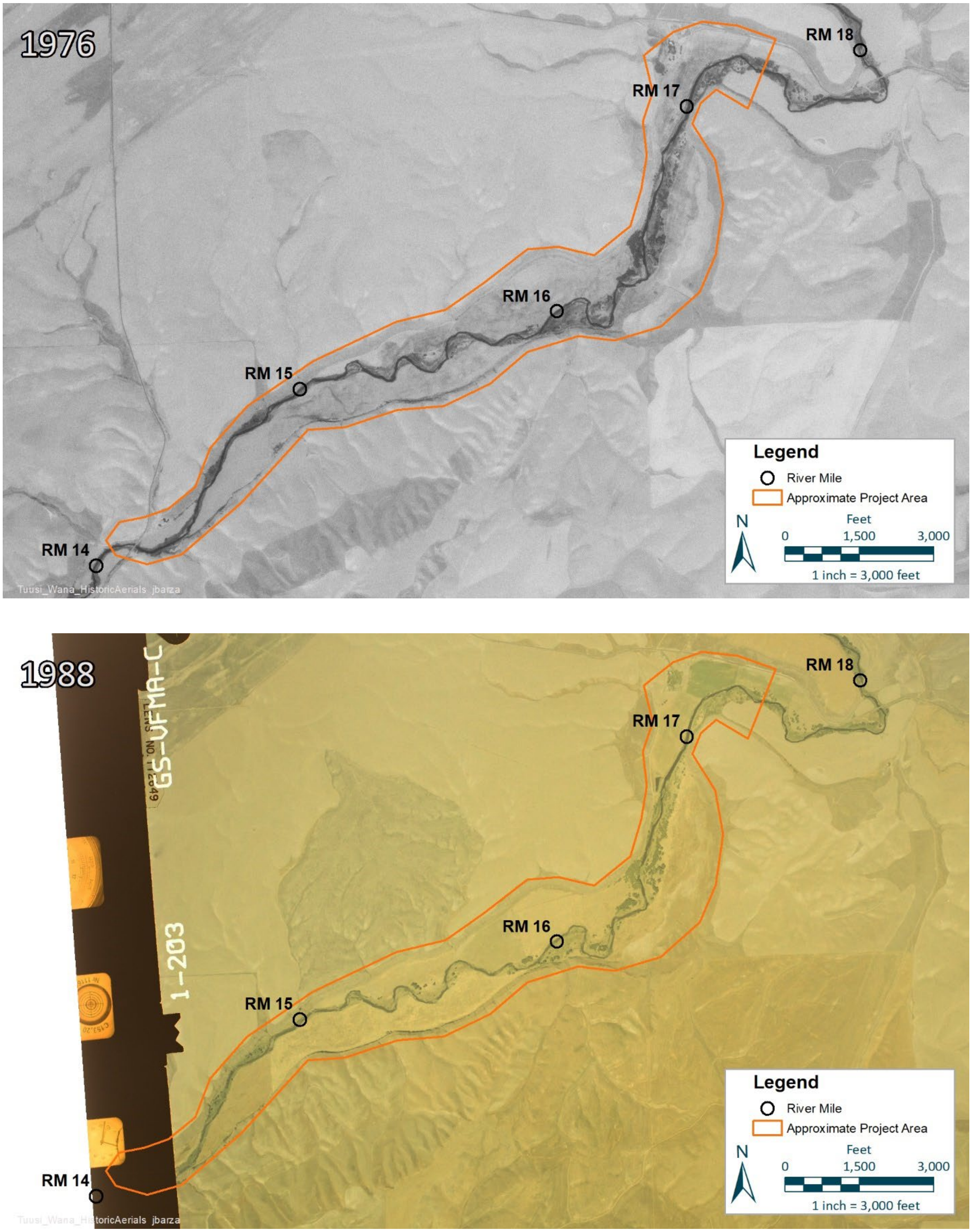
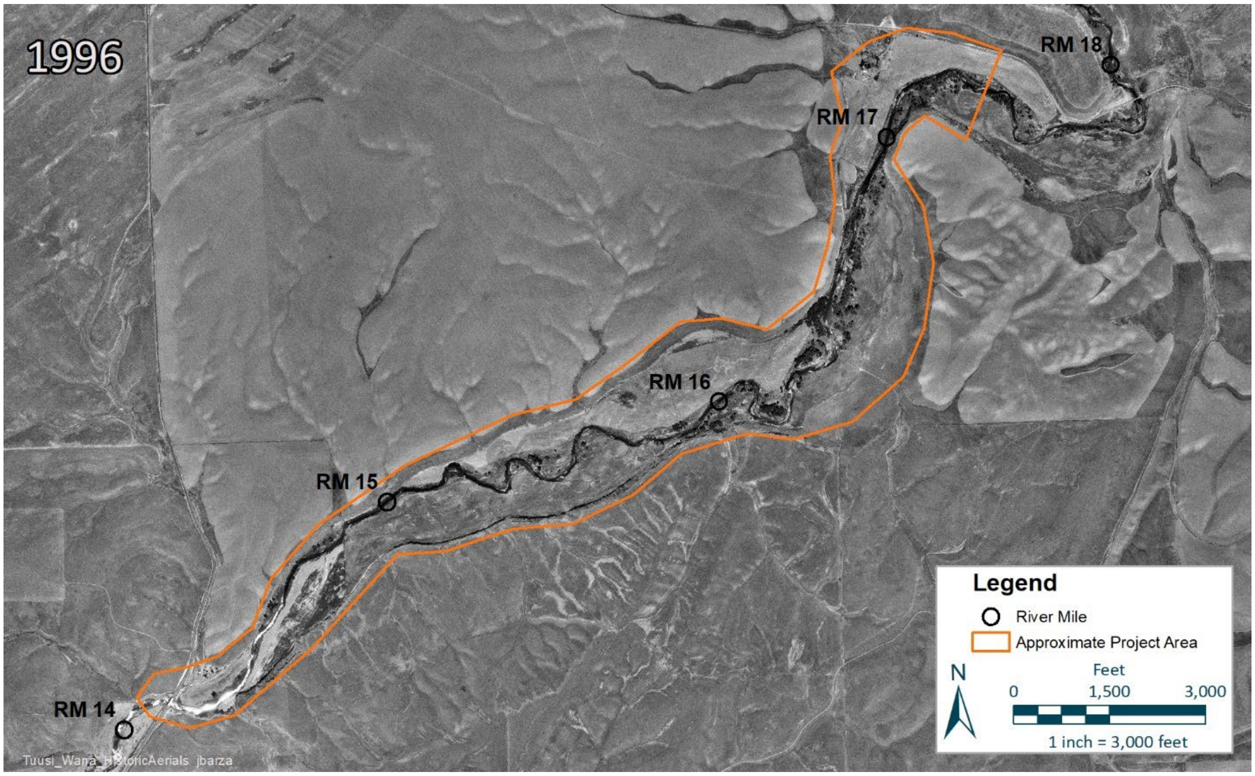


Figure 8. Aerial imagery from 1976 and 1988.



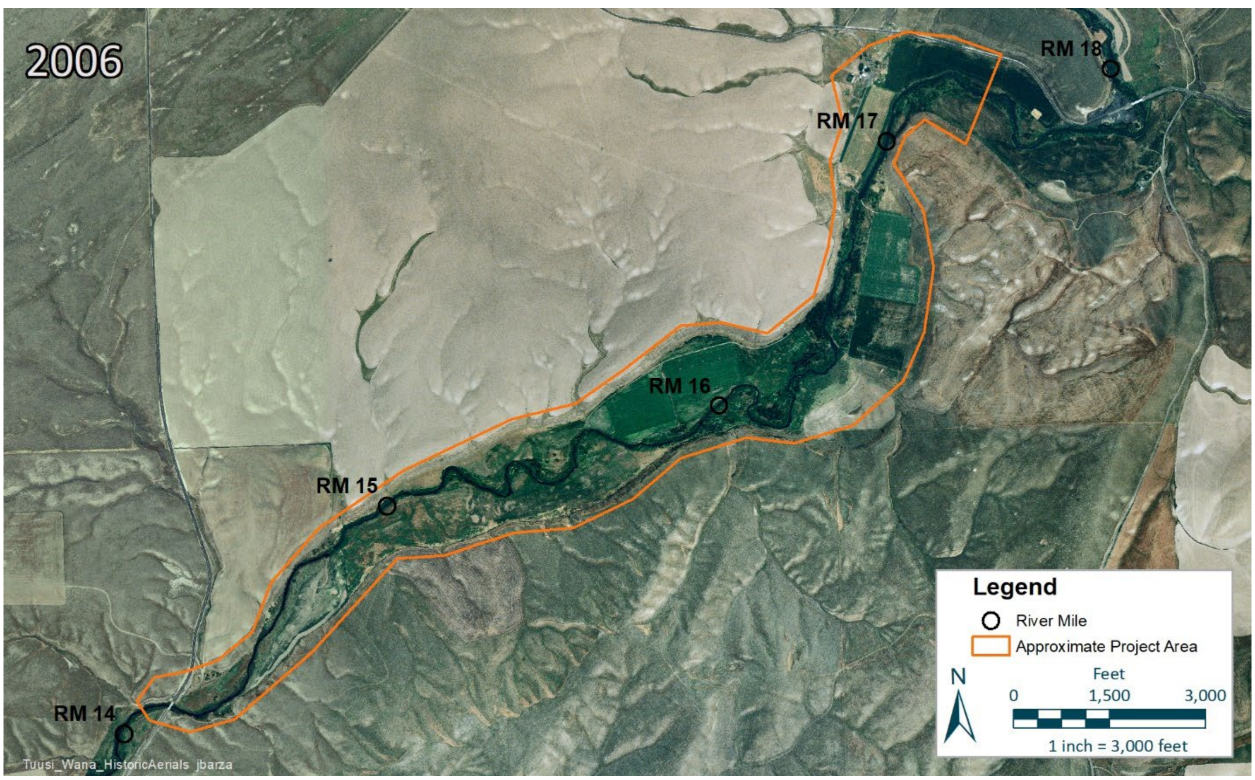


Figure 9. Aerial imagery from 1996 and 2006.

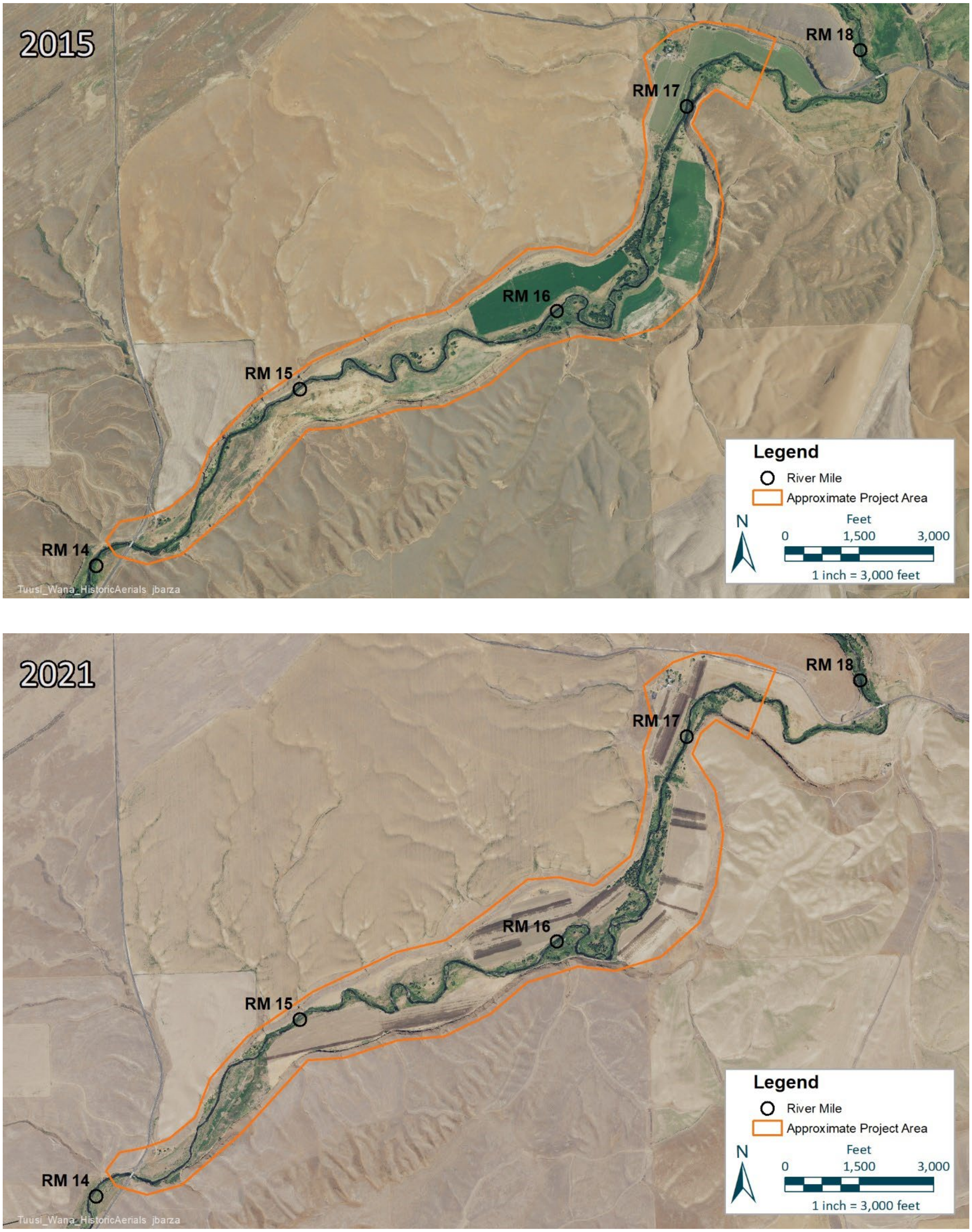


Figure 10. Aerial imagery from 2015 and 2021.

2.2 DESCRIPTION OF EXISTING GEOMORPHIC CONDITIONS AND CONSTRAINTS ON PHYSICAL PROCESSES.

Geomorphic conditions in the project area have been heavily impaired by floodplain aggradation, channelization, bank armoring (riprap), floodplain grading, and riparian clearing. The main channel is isolated from most of its floodplain due to significant aggradation of fine sediments (10+ feet in many locations) along the floodplain (floodplain aggradation. Riparian clearing has reduced wood recruitment and floodplain roughness, which historically would have driven channel change (e.g., split flow conditions, moderated lateral channel migration), and created associated habitat. Restrictions on lateral migration due to anthropogenic disturbances have resulted in downcutting and channel incision, but that has been largely outpaced by floodplain aggradation associated with fine sediments eroding from the floodplain and adjacent hillslopes. These processes have lowered the elevation of the Touchet River relative to the floodplain.

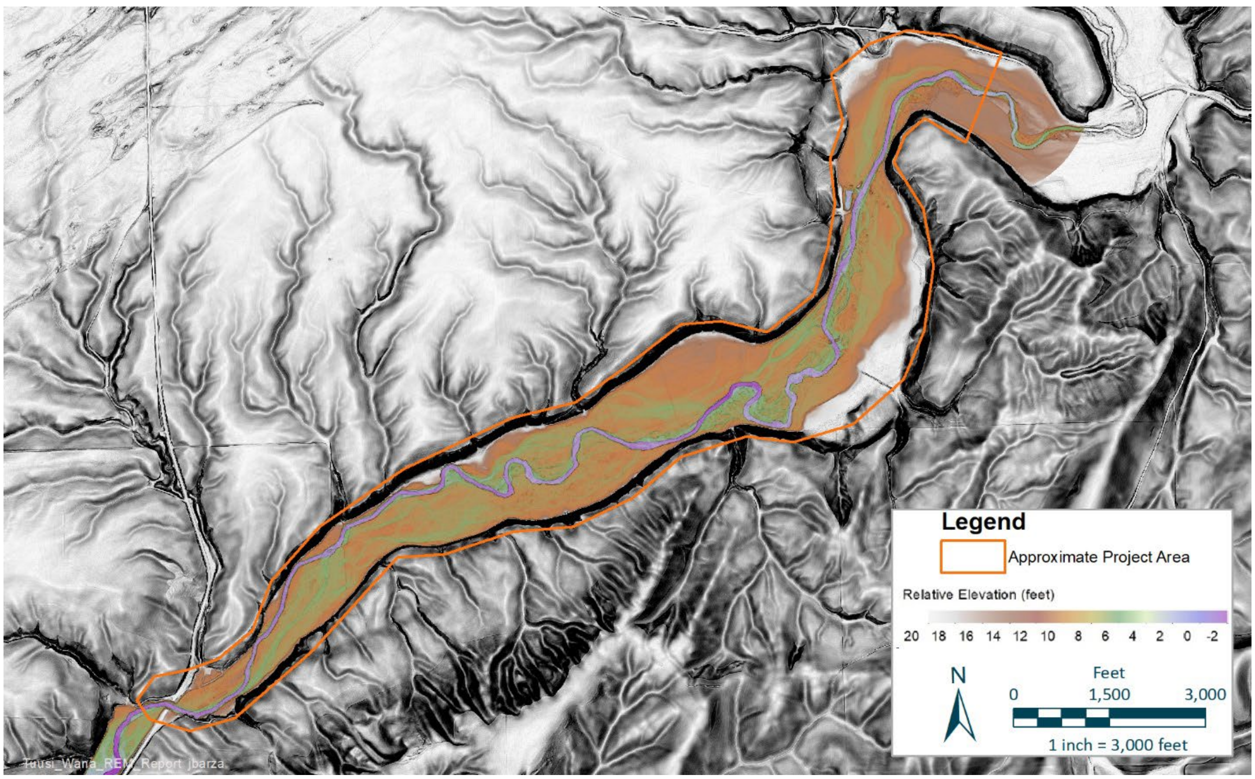


Figure 11. LiDAR elevation data of the project area, showing hillslopes, and historical floodplain areas.

2.3 DESCRIPTION OF EXISTING RIPARIAN CONDITION AND HISTORICAL RIPARIAN IMPACTS.

Lewis and Clark passed near the project site on April 30 to May 1, 1806. Their journals describe (University of Nebraska Press 2005):

> *"small cotton trees, birch, elder rose, Crimson haw, red willow, Sweet willow, Choke Cherry, yellow current, goose berry, white berried honey suckle, rose bushes, Seven bark, Shoemate, and rushes."*

> *"we had the pleasure once more to find an abundance of good wood for the purpose of making ourselves comfortable fires, which has not been the case since we left rock fort camp"*

Riparian clearing began early in Euro American settlement and has occurred throughout the project area, continuing until at least 1996. This has resulted in an immature riparian community which provides limited shade, limited structure to drive and moderate channel migration, and limited instream wood sources compared to historical conditions. Floodplain aggradation also disconnected large portions of the valley floor from intermediate flood events (e.g., 2-year, 5-year). This, combined with agricultural clearing and grading, has resulted in a valley floor largely devoid of floodplain vegetation assemblages that would be typical of the region's intermediate floodplain surfaces (e.g., cottonwood). As the floodplain aggraded relative to the channel, smaller inset point bars and floodplains have developed, and today, riparian plant assemblages have occupied these surfaces. Many of these surfaces have been occupied by False Indigo (*Amorpha fruticosa*), which was planted by the Civilian Conservation Corps in an effort to halt stream erosion (J. Gailey, personal communication, May 5, 2022). False indigo now occupies the habitat niche that historically was likely occupied by shrub willows (
Figure 12 Representative image of False indigo occupying the historical niche of shrub willow (e.g., Salix exigua)). Field observation and examination of the aerial photo record suggest surfaces were cleared of the remainder of vegetation by the 1970s and consequently contain primarily pasture grasses with few remnant cottonwoods visible from historical flood events.

Figure 12 Representative image of False indigo occupying the historical niche of shrub willow (e.g., Salix exigua)

2.4 DESCRIPTION OF LATERAL CONNECTIVITY TO FLOODPLAIN AND HISTORICAL FLOODPLAIN IMPACTS.

Lateral connectivity in the project area is heavily impaired by channelization, riprap, and riparian clearing. The mainstem is separated from most of its floodplain by aggradation, which has been present since at least the 1970s. Riparian clearing and lack of hydraulic roughness have accelerated lateral migration rates when compared with historical conditions in certain locations, and evidence of armoring and prior conservation measures (e.g., planting and fabric placement) in an effort to halt or slow erosion. As the lateral migration of the channel has been restricted in some areas, it has responded by rapidly eroding in other locations.

2.5 TIDAL INFLUENCE IN PROJECT REACH AND INFLUENCE OF STRUCTURAL CONTROLS (DIKES OR GATES)

There is no tidal influence in the project area.

3. Technical Data

3.1 INCORPORATION OF HIPIV SPECIFIC ACTIVITY CONSERVATION MEASURES FOR ALL INCLUDED PROJECT ELEMENTS.

HIP conservation measures have been incorporated into project elements included in the design (see accompanying Project Plans). As the project elements are refined, additional information will be provided as needed.

3.2 SUMMARY OF SITE INFORMATION AND MEASUREMENTS (SURVEY, BED MATERIAL, ETC.) USED TO SUPPORT ASSESSMENT AND DESIGN.

3.2.1 Topographic and Bathymetric Data

A LiDAR data set (Quantum Spatial 2018) was available to supplement onsite topographic data collection. Topographic and bathymetric survey data were collected within the project area by Inter-Fluve[1] in May 2022. Topographic survey data were collected using total station and RTK GPS. Bathymetric survey data was collected using an echo-sounder connected to RTK GPS. These data were collected to ground-truth existing LiDAR and provide bathymetry for hydraulic modeling and design. In general, good agreement was found between the LiDAR bare earth surface raster and ground survey data. An analysis of 352 upland ground survey points (Figure 13) indicated that the survey elevations are an average of 0.24-feet lower than the LiDAR bare earth elevations. Survey elevations that are lower than LiDAR elevations are typical for natural areas with low dense vegetation cover that the LiDAR returns reflect off of and areas with ongoing erosion (e.g. steep banks). To provide the best representation of expected pre-project conditions, the bathymetric and ground survey data were combined with the 2018 LiDAR data to construct a pre-project conditions surface for design and hydraulic modeling.

[1] Consistent with the Washington Board of Registration for Professional Engineers and Land Surveyors Policy No. 42 on incidental survey work (WBRPELS 2007), site surveys were conducted under the direction of a licensed professional engineer at Inter-Fluve and are intended for use toward the development this project's engineered design.

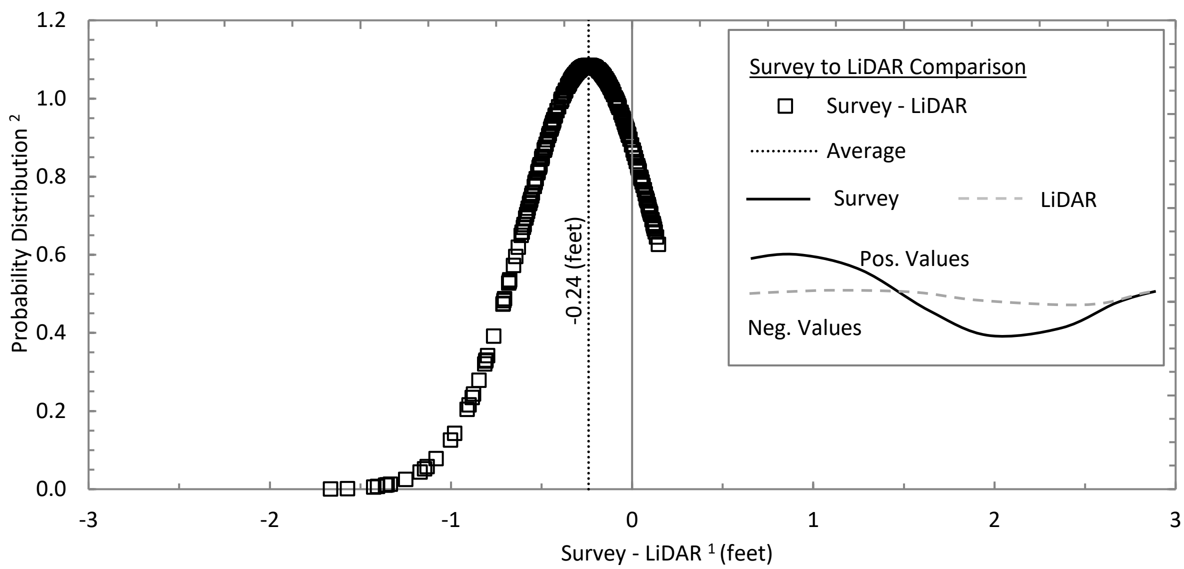


Figure 13. Survey comparison to LiDAR ground elevations.

Figure Notes:

[1] Difference in elevation is the May 2022 survey point elevation minus the 2018 LiDAR bare earth elevation for the raster cell containing the survey point.

[2] Probability distribution calculated using 352 upland ground survey points with a standard deviation of 0.37-feet.

3.2.2 Bed Material Data

No bed material samples were conducted during the survey. However, fine sediment along the bed and banks was observed at depths of three plus feet during the survey until refusal (alluvium) was encountered. Five test pits to determine depth to alluvium (gravel, cobble) and the water table were completed in November of 2022. These test pits show a close correlation between the river's water surface elevation and the water table elevation in the floodplain. These test pits also demonstrated a close correlation between the maximum elevation of coarse alluvium (gravel, cobble) in the channel banks to the maximum elevation of coarse alluvium in the floodplain. Test pits also generally indicated an average of 8 to 10 feet of fine sediment atop alluvium (see Table 6 and Figure 6).

3.2.3 Aerial Photography and Historical Survey Records

Historical aerial images of the site were obtained from USGS Earth Explorer and CTUIR. Imagery of the project area was collected for 1952, 1964, 1976, 1996, 2006, 2015, and 2021to evaluate historical land use.

3.2.4 Fish Use Data

Juvenile and adult fish use data were provided by the Snake River Salmon Recovery Board, Washington Department of Fish and Wildlife, and Walla Walla Subbasin Salmonid Monitoring and Evaluation Reports (Mendel et al. 2014). These data are used to characterize existing and potential future use of the project area by salmon, steelhead, and other fish species.

3.3 SUMMARY OF HYDROLOGICAL ANALYSES CONDUCTED, INCLUDING DATA SOURCES AND PERIOD OF RECORD INCLUDING A LIST OF DESIGN DISCHARGE (Q) AND RETURN INTERVAL (RI) FOR EACH DESIGN ELEMENT.

3.3.1 Hydrology Data

Relevant streamflow gages are located on the Touchet River and on the Walla Walla River near the confluence with the Touchet River. These gages include:

- Touchet River at Luckenbill Rd.
  WADOE Gage 32B090, period of record May 2022 to present
- Touchet River at Cummins Road (near Touchet, WA)
  WADOE Gage 32B075, period of record June 2002 to present
  USGS Gage 14017500, period of record 1942 to 1964
- Walla Walla River near Touchet, WA
  USGS Gage 14018500, period of record 1949 to present

Stream flow data from these gages were used for annual and monthly hydrologic analyses (Table 4 and Figure 14). To compensate for the more limited and periodic period of record on the Touchet River a discharge relationship analysis was completed relative to the much longer period of record on the Walla Walla River. This relationship was used to transfer peak flow statistics for the 2- through 25-year recurrence interval events from the Walla Walla gage to the Touchet River gage at Cummins Road.

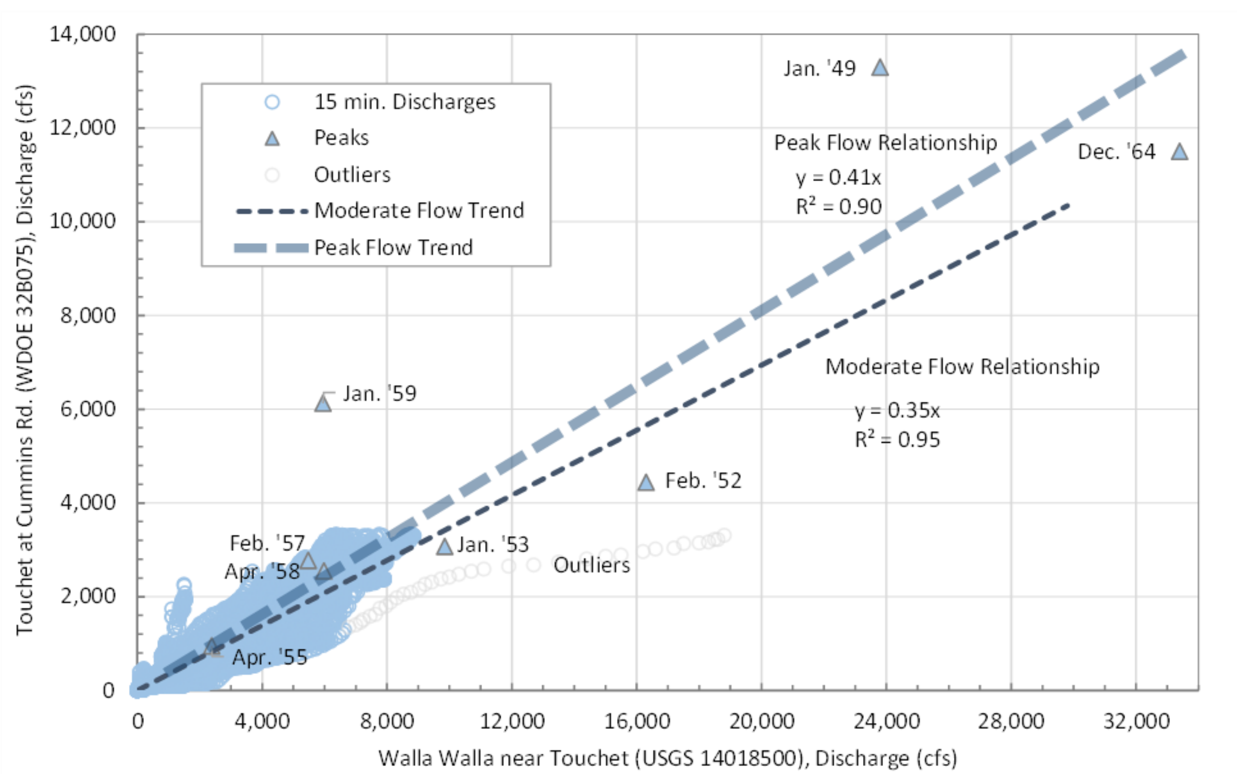


Figure 14 . Flow relationship between the Walla Walla River near Touchet and the Touchet River at Cummins Road.

3.3.2 Peak Flows

The project reach peak flow estimates are presented in Table 4.

Table 4. Project Reach Peak Flows.

Discharge Statistic	Discharge (cfs)	Source
2-year (equivalent to OHW)	2,048	Gage transfer values [A]
5-year	3,605	Gage transfer values [A]
10-year	4,900	Gage transfer values [A]
25-year	7,954	Gage transfer values [A]
50-year	13,930	Regional analysis [B]
100-year	16,850	Regional analysis [B]
200-year	19,960	Regional analysis [B]
500-year	24,580	Regional analysis [B]

Table Notes:
[A] Uses gage transfer techniques from the flood frequency analysis on the Walla Walla USGS Gage 14018500. Values not scaled to the project site from the Touchet River gage at Cummins Road as these peak flows are generated from hydrologic events (snow melt and rainfall) upstream of the project site and Cummins Road gage.
[B] Uses regional regression techniques per Mastin 2018. Values scaled to the project site from the Touchet River gage at Cummins Road to account for a decrease in contributing watershed area during these events likely driven by both local and upper watershed hydrologic events.

Design Flows

The estimated peak discharge for the 25-year (Q25) recurrence interval will be used as the design discharge for large wood structure stability. The 2-year peak discharge (Q2) was found to agree with the observed ordinary high water (OHW) marks and was used to extend the OHW delineation throughout the project.

3.3.3 Seasonal Flows

The project reach seasonal flow estimates are presented in Figure 15 and Table 5.

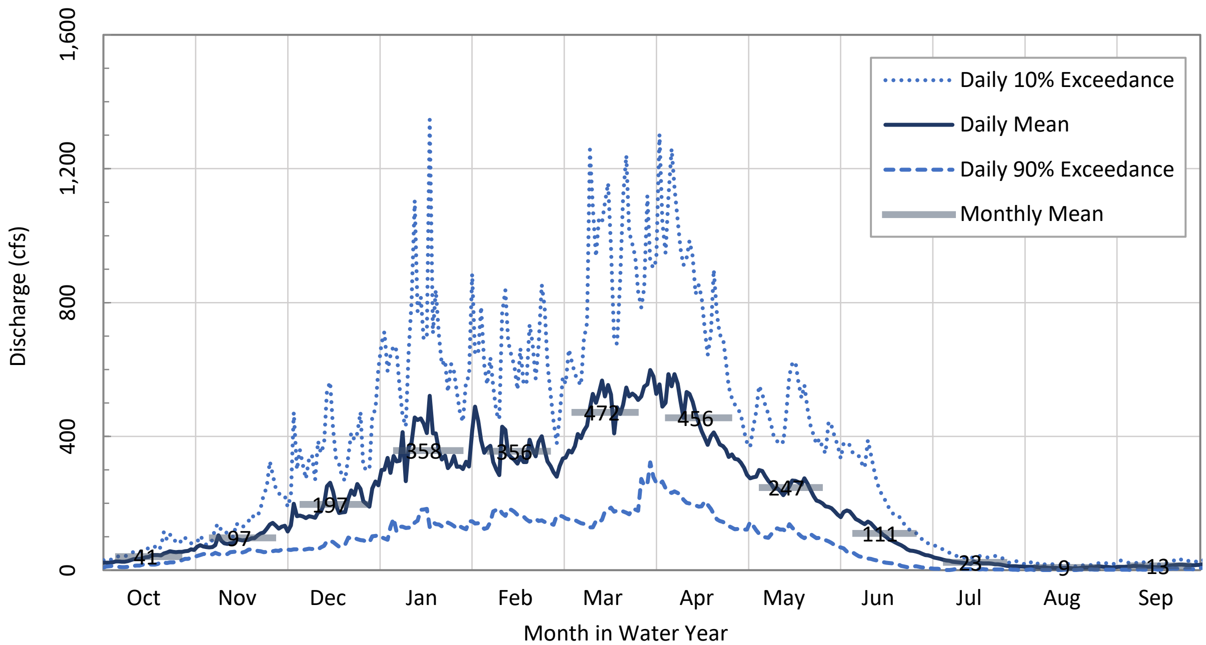


Figure 15. Annual Hydrology Statistics |Touchet River at RM 14 | Water Years 2003 to 2021.

Figure Notes: Uses statistical analysis of gage data from WADOE Gage 32B075 (period of record Water Year 2003-2021) with discharge values adjusted from the gage near river mile 3 to the project site near river mile 14 using a direct basin area correction.

Table 5. Project Reach Seasonal Flows.

Discharge Statistic	Discharge (cfs)	Source
Minimum Recorded	0	Gage analysis [C]
August Average	9	Gage analysis [C]
December Average	197	Gage analysis [C]
November '22 Survey	270	Gage data [D]
March Average	472	Gage analysis [C]
Fish Flows	750	Selected value
May '22 Survey Average	1,000	Gage data [D]

Table Notes:
[C] Uses statistical analysis of gage data from WADOE Gage 32B075 (period of record Water Year 2003-2021) with discharge values adjusted from the gage near River Mile 3 to the project site near River Mile 14 using a direct basin area correction.
[D] Gage data from WADOE Gage 32B090

A selected value of 750 cfs, representative of a typical high flow event, was used as the design discharge for evaluation of habitat enhancement.

3.4 SUMMARY OF SEDIMENT SUPPLY AND TRANSPORT ANALYSES CONDUCTED, INCLUDING DATA SOURCES INCLUDING SEDIMENT SIZE GRADATION USED IN STREAMBED DESIGN.

Field observations (bathymetric depth of refusal survey, site assessment (Figure 16), test pits (Table 6) all indicate there is a significant amount of fine sediment that has moved into the system, much of which has infilled atop the historical floodplain surface. These field observations are supported by evidence of erosion in the Palouse and sediment infilling rates related to agricultural clearing in the Walla Walla Basin (USDA 1979, USGS 1998, USGS 1969).

The presence of fine sediment indicated that large-scale grading/excavation on the floodplain or as part of side channels would face significant likelihood or undesirable deposition or infilling. Due to the proposed nature of the work (i.e., large wood structures, revegetation), additional sediment modeling was not deemed necessary for design efforts.

Figure 16 Fine sediment along the banks near RM 15.7

Table 6 Test pit data demonstrating the range of depths from the floodplain ground surface to alluvium (gravel/cobble) and the modeled low water surface. The modeled low water surface at the time of the test pits was derived from comparison of calibrated surveyed water surface elevations at the time of the test pits (270 cfs) to modeled low flow (9 cfs).

FLOODPLAIN TEST PIT	MODELED LOW WATER SURFACE ELEVATION	GROUND SURFACE ELEVATION	DEPTH FROM GROUND TO LOW WATER SURFACE	ALLUVIUM ELEVATION (GRAVEL/COBBLE)	DEPTH FROM GROUND SURFACE TO ALLUVIUM
1	706.7	717.1	10.4	710.07	7.0
2	683.4	695.2	11.8	686.19	9.0
3	681.7	694.1	12.4	686.53	7.6
4	680.5	687.6	7.1	685.88	1.7
5	708.22	720.5	12.3	712	8.5

3.5 SUMMARY OF HYDRAULIC MODELING OR ANALYSES CONDUCTED AND OUTCOMES – IMPLICATIONS RELATIVE TO PROPOSED DESIGN.

For the proposed project, two-dimensional (2D) hydraulic models were developed for the pre-project conditions, and the proposed design conditions. The 2D hydraulic models for the site were developed in the U.S. Army Corps of Engineers HEC-RAS 6.3.1 software (USACE 2022) for modeling the hydraulics of water flow through natural rivers and other channels. The following sections describe HECRAS 6.2 and document the development and output processing of the existing and proposed conditions models.

3.5.1 Model Capabilities and Limitations

HEC-RAS 6.3.1 was used in its two-dimensional (2D) unsteady flow simulation mode with the capacity to model the complex flow patterns, on-site water storage, and temporally variable boundary conditions. The 2D hydraulic model calculates depth averaged water velocities (including magnitude and direction), water surface elevation, and mesh cell face conveyance throughout the simulation. Other hydraulic parameters, such as depth, shear stress, and stream power, can be calculated after the simulation. The model does not simulate vertical variations in velocities or complex three-dimensional (3D) flow eddies.

3.5.2 Model Extent

The project reach model extends from approximately river mile 14.3 upstream of the Touchet North Road bridge up to river mile 17.7 downstream of the Luckenbill Rd Bridge, and spans across the valley to elevations well above the 100-year flood elevation. Both the upstream and downstream boundaries of the model are located at a relatively confined section of the valley. The boundaries are also sufficiently far away from the bridges to avoid their effects.

3.5.3 Model Terrain

The base-line conditions model terrain was developed using both ground/bathymetric survey data collected by Inter-Fluve staff in 2022 along with aerial LiDAR acquired in 2018 (Quantum Spatial 2018). More information can be found in Section 3.2.1 of this report. The model terrain is projected on the Washington State Plane South Zone, North American Datum 1983 (NAD83), coordinate system with US feet distance units. The terrain elevations are in US feet relative to the North American Vertical Datum of 1988 (NAVD88).

3.5.4 Model Geometry

The 2D model geometry used a flexible computational mesh adjusted according to terrain complexity and areas of interest. The nominal mesh spacing was 50 feet in the floodplain and 10 feet in the channel. Break lines were added to further refine the mesh along the tops of banks and channel alignments. Although the average computation mesh size was greater than the terrain resolution, the modeling capabilities of HEC-RAS 6.3.1 integrates the sub-grid terrain into the computations. This capability allows small features such as narrow channels and floodplain hummocks to be shown in the model output.

3.5.5 Model Roughness

Roughness coefficients (Manning's n values) are used by the 2D model to calculate flow energy losses, or frictional resistance, caused by channel bed materials and floodplain vegetation. Existing conditions roughness coefficients were applied across the model extent to represent the various types and densities of vegetation or surface conditions. In general, roughness regions were delineated based on field observations and aerial photos. Roughness values for each region were selected using published guidelines (Arcement & Schneider 1989) for channel types and vegetation conditions. Table 7 summarizes the roughness coefficients used in the models.

Table 7: Roughness coefficients used in the 2D model

Region description	Manning's n value
Main active river channel; typical cobble/gravel bed	0.022
Riparian Vegetation	0.08 – 0.12
Grass on Valley Hills	0.05
Channel Islands/ Bars	0.06
Farm fields and orchards; seasonal crops or maintained orchard	0.04
Paved Roads	0.015
Residential Buildings	0.085
Exposed Dirt	0.04

3.5.6 Model Discharges

The modeled discharges of interest included all the flows listed in Table 4 and Table 5. These discharges were incorporated into a synthetic hydrograph with periods of steady flow (at the discharges of interest and other intermediate discharges) connected by smooth transition periods to create a stair-step like pattern. The periods of steady flow allow the model to come to a quasi-steady state condition improving the interpretation of hydraulics at specific discharges.

3.5.7 Model Boundary Conditions

HEC-RAS 6.3.1 2D models require boundary conditions at the upstream and downstream ends of the model to control the flow into and out of the model extent. The synthetic hydrograph described above was applied as the upstream boundary condition. The flow was initially distributed along the boundary assuming normal flow depth at a friction slope estimated from the average channel slope upstream of the model (0.004 feet per foot). The downstream boundary condition assumed normal flow depth at a friction slope estimated from the average channel slope downstream of the model (0.003 feet per foot).

3.5.8 Model Output

To examine the inundation patterns, velocities, and other hydraulic parameters within the model extent for existing and proposed conditions, the RAS Mapper utility of HEC-RAS 6.3.1 was used to generate results in the form of raster data sets at the discharges of interest. These raster data sets were then loaded into an ESRI ArcMap file to prepare various figures depicting inundation extent, velocity magnitude, and sediment mobility for existing and proposed conditions. These figures are included in Appendix 7.5.

3.5.9 Model Validation

The model was validated by comparing the model water surface elevations (WSE) at 1,000cfs to elevations that were surveyed during the May 2022 topo/bathy survey, which occurred when the Touchet river was 1,000 cfs on the DOE 32B090 gage. 3740 points were used for the comparison. The difference between the surveyed WSE and Modeled WSE are shown in Figure 17. The root mean square average of the difference in WSE was 0.27 ft, suggesting a good agreement between the model and surveyed conditions.

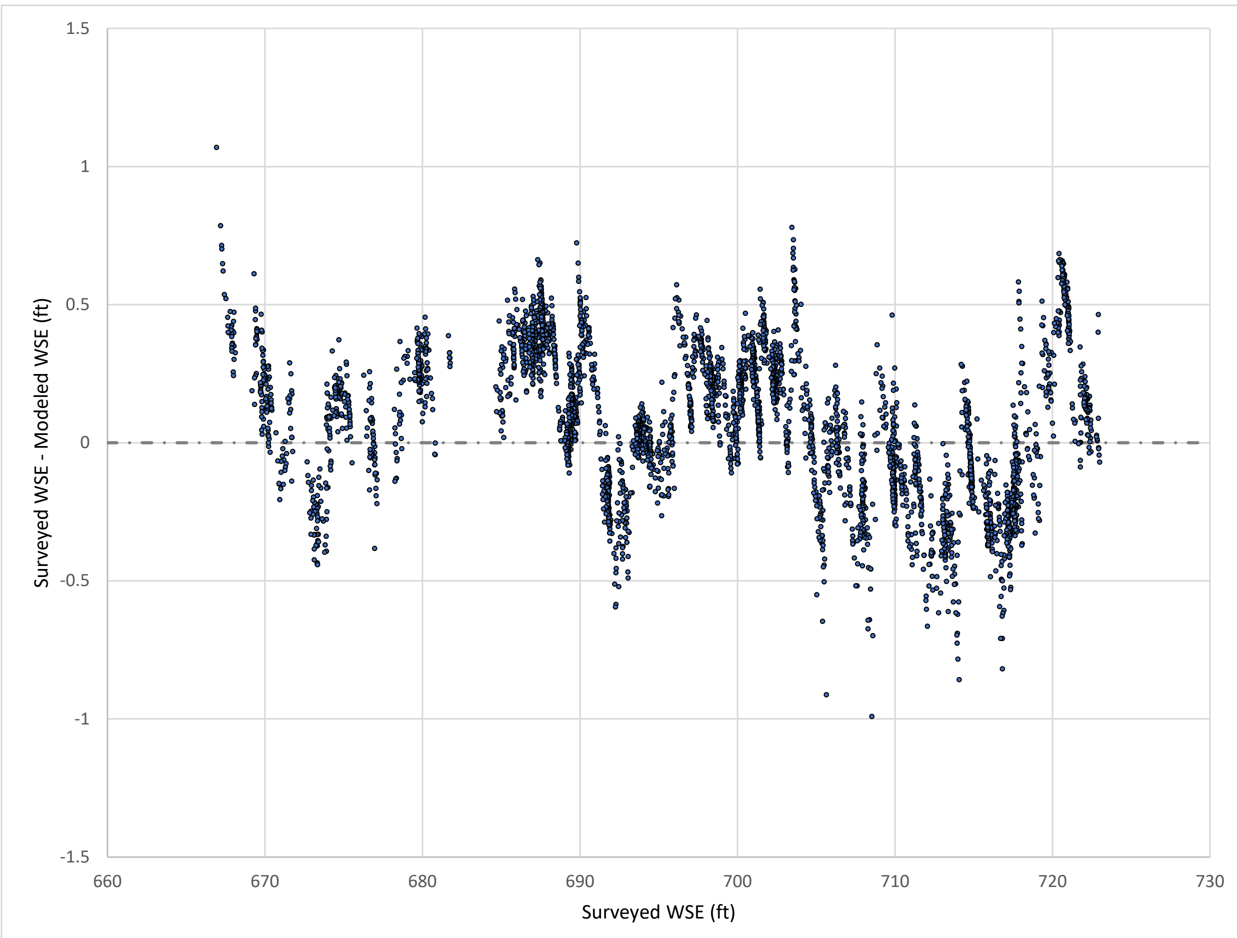


Figure 17 Touchet River Model Validation at 1,000 cfs

3.6 STABILITY ANALYSES AND COMPUTATIONS FOR PROJECT ELEMENTS, AND COMPREHENSIVE PROJECT PLAN.

Stability analysis and computations for project elements will follow professional practice guidelines for large wood design (Knutson et. al. 2014 and USBR/ERDC 2016), stream habitat restoration (Cramer 2012), bank treatments (Cramer 2003), and institutional knowledge combined with professional judgment for the design of specific project elements.

The project setting includes downstream and upstream bridges, agricultural and residential structures, overhead powerlines & utility poles in the floodplain, tilled and untilled agricultural fields on the floodplain, and irrigation pump stations along the channel. The reach recreational use is low without good access given the nearly continuous private properties in the area. The LWS characteristics include locations within the active channel and on the outside of bends, they are designed to have low strainer potential and egress is moderate. Sight distance to LWS will be moderate to high and the depth x velocity at recreational use flows will be moderate to low. Given this setting, the project large wood structures are being designed assuming a 'low' public safety risk and a 'moderate' property damage risk level (Knutson et. al. 2014). Using these risk levels results in recommended minimum factors of safety in the horizontal and vertical directions of 1.5 and 1.75, respectively at the 25-year peak flow, to maintain a stable structure under design conditions (Knutson et. al. 2014). Proposed conditions 2D hydraulic model outputs for the 25-year peak flow event (Table 4) will be used to determine conservative design velocities upstream of each structure type, and conservative assumptions relative to the sizes of individual log members will be made in accordance with the Project Plans and Specifications. The computed factor of safety will be shown to equal or exceed the recommended factors of safety for each structure type, indicating that the structures can be considered stable for the assumed risk profile. The preliminary framework for the stability analysis are summarized in Table 8, and will be further refined during future design phases. Additional detailed stability analysis documentation for LWS will be provided at final design.

Table 8. Summary of preliminary large wood stability analysis results.

Large wood Structure Type	Recommended Factors of Safety [A] Horizontal (Sliding)	Recommended Factors of Safety [A] Vertical (Buoyancy)	Calculated Factors of Safety Horizontal (Sliding [B])	Calculated Factors of Safety Horizontal (Timber [C])	Calculated Factors of Safety Vertical (Buoyancy)	Stable Under Design Conditions?
Apex	1.5	1.75	*Values to be calculated based on the Final Designs*			
Bank - Buried	1.5	1.75				
Floodplain	1.5	1.75				
Off-Channel PALS	1.5	1.75				

Table Notes: [A] Knutson et. al., 2014 | | [B] This is the vertical log soil strength and bed friction factor of safety. | [C] This is the vertical log (timber) factor of safety against breaking off.

3.7 DESCRIPTION OF HOW PRECEDING TECHNICAL ANALYSIS HAS BEEN INCORPORATED INTO AND INTEGRATED WITH THE CONSTRUCTION – CONTRACT DOCUMENTATION.

The construction contract documentation specifically defines values for parameters critical to their performance based on the technical analysis described above. The parameter values (dimensions, weights, and other material properties) will be set to allow for a reasonable amount of variation to improve constructability without compromising project performance. Additionally, it is generally expected that the design engineer, or their representative, will be on site during critical phases of construction to assist in making field designs adjustments that are consistent with the project intent and technical analysis.

3.8 FOR PROJECTS THAT ADDRESS PROFILE DISCONTINUITIES (GRADE STABILIZATION, SMALL DAM AND STRUCTURE REMOVALS): A LONGITUDINAL PROFILE OF THE STREAM CHANNEL THALWEG FOR 20 CHANNEL WIDTHS UPSTREAM AND DOWNSTREAM OF THE STRUCTURE SHALL BE USED TO DETERMINE THE POTENTIAL FOR CHANNEL DEGRADATION.

Not applicable.

3.9 FOR PROJECTS THAT ADDRESS PROFILE DISCONTINUITIES (GRADE STABILIZATION, SMALL DAM AND STRUCTURE REMOVALS): A MINIMUM OF THREE CROSS-SECTIONS – ONE DOWNSTREAM OF THE STRUCTURE, ONE THROUGH THE RESERVOIR AREA UPSTREAM OF THE STRUCTURE, AND ONE UPSTREAM OF THE RESERVOIR AREA OUTSIDE OF THE INFLUENCE OF THE STRUCTURE) TO CHARACTERIZE THE CHANNEL MORPHOLOGY AND QUANTIFY THE STORED SEDIMENT.

Not applicable.

4. Construction – Contract Documentation

4.1 INCORPORATION OF HIPIV GENERAL AND CONSTRUCTION CONSERVATION MEASURES

All HIP general and construction conservation measures will be met unless otherwise indicated through a variance request at later design phases.

4.2 DESIGN – CONSTRUCTION PLAN SET INCLUDING BUT NOT LIMITED TO PLAN, PROFILE, SECTION AND DETAIL SHEETS THAT IDENTIFY ALL PROJECT ELEMENTS AND CONSTRUCTION ACTIVITIES OF SUFFICIENT DETAIL TO GOVERN COMPETENT EXECUTION OF PROJECT BIDDING AND IMPLEMENTATION.

See accompanying Project Plans.

4.3 LIST OF ALL PROPOSED PROJECT MATERIALS AND QUANTITIES.

See accompanying Project Plans and Opinion of Probable Construction Costs (OPCC).

4.4 DESCRIPTION OF BEST MANAGEMENT PRACTICES THAT WILL BE IMPLEMENTED AND IMPLEMENTATION RESOURCE PLANS INCLUDING:

4.4.1 Site Access, Staging, and Sequencing Plan.

The site access, staging, and sequencing plan will be in conformance with the HIPIV General Aquatic Conservation Measures (see Project Plans). Site access will be from Luckenbill Road. The primary staging area will be on the Touchet River Ranch property in the location shown on the Plans. The staging area will be entirely above the ordinary high-water elevation. Straw wattles will be installed on the downslope sides of the staging area in the event of wet weather during construction. Depending upon site conditions during construction, a stabilized rock construction entrance may also be installed at the access point off Luckenbill Road to minimize tracking of fine sediment off site.

4.4.2 Work Area Isolation and Dewatering Plan.

Work area isolation and dewatering will be in conformance with the HIP General Aquatic Conservation Measures (see Plan Sheet 3, 4, and 5 including; *Work Area Isolation & Fish Salvage*). Work areas in the wetted channel during construction will be isolated from surface water flow and de-fished prior to excavation, pile driving, and large wood placement. Surface water isolation measures may include; bulk bag, sheet pile, or concrete block coffer dams. Turbidity curtains and fish exclusion nets may be used on their own in slack water areas to isolate the work area where dewatering is not needed or in conjunction with coffer dams as needed to further limit turbidity releases and exclude fish from the work area. Work requiring dewatering will be kept pumped down to below the working level. Water from dewatering pumping is expected to be turbid and will be discharged to an upland location for infiltration. The Plans show recommended work area isolation measures; however, a final plan will be developed by the contractor for review and acceptance by the construction contracting agency. The construction contractor will be responsible for adherence to and implementation of the accepted plan.

4.4.3 Erosion and Pollution Control Plan.

The project erosion and pollution control plan will be in conformance with the HIP General Conservation Measures (see Plan Sheet 3 including; *Item 9 and Item 10*) as well as applicable State and local regulations. The Plans show recommended erosion and pollution control measures; however, the final plan will be developed by the contractor for review and acceptance by the construction contracting agency. The construction contractor will be responsible for adherence to and implementation of the accepted plan.

4.4.4 Site Reclamation and Restoration Plan.

Site reclamation and restoration will be in conformance with the HIP General Conservation Measures (see Plan Sheet 3 including; *Item 5*). All temporary construction access roads and staging areas will be returned to pre-project conditions or better. Where revegetation is required to restore pre-project conditions areas will be mulched and seeded with a native species mix.

4.4.5 List proposed equipment and fuels management plan.

The construction contractor will be required to provide a list of proposed equipment and a fuel management plan for review and acceptance by the construction contracting agency. The equipment brought onto the site and fuel management plan prepared by the contractor will be in conformance with the HIPIV General Conservation Measures (see Plan Sheet 3 including; *Item 8* and Plan Sheet 4 *Item 11)*. The contractor will also be responsible for development and implementation of a spill prevention, control, and counter measures plan that conforms to the HIPIV General Aquatic Conservation Measures (see Plan Sheet 3 including; *Item 11*) as well as applicable State and local regulations. The plan will be reviewed and accepted by the construction contracting agency prior to mobilization. The construction contractor will be responsible for adherence to and implementation of the accepted plan. In general, it's expected that construction equipment could include; tracked excavators, wheeled loaders, tracked log loaders, off-highway haul trucks, on-road dump trucks, chain saws, gas, electric, or air powered drills, gas powered abrasive cut-off saws, excavator mounted hydraulically driven side grip vibratory pile driver, work trucks, and other small power/hand tools. Equipment will be stored in the primary upland staging, outside the ordinary high-water line, while not in use.

4.5 CALENDAR SCHEDULE FOR CONSTRUCTION/IMPLEMENTATION PROCEDURES.

To be completed following the advertisement for bids.

4.6 SITE OR PROJECT SPECIFIC MONITORING TO SUPPORT POLLUTION PREVENTION AND/OR ABATEMENT.

The Contracting Officer, or their representative, will be on site frequently to monitor the construction Contractor's compliance with the approved pollution prevention plan and document any work done to abate site erosion, turbid water, or chemical spills.

5 Monitoring and Adaptive Management Plan.

Section 5 and all subsequent sections to be completed by the Tribes in a separate document(s).

5.1 INTRODUCTION

5.2 EXISTING MONITORING PROTOCOLS

5.3 PROJECT EFFECTIVENESS MONITORING PLAN

5.3.1 Objective 1

5.3.2 Objective 2

5.4 PROJECT REVIEW TEAM TRIGGERS

5.5 MONITORING FREQUENCY, TIMING, AND DURATION

5.5.1 Baseline Survey

5.5.2 As-Built Survey

5.5.3 Monitoring Site Layout

5.5.4 Post-Bankfull Event Survey

5.5.5 Future Survey (Related to Flow Event)

5.6 MONITORING TECHNIQUE PROTOCOLS

5.6.1 Photo Documentation and Visual Inspection

5.6.2 Longitudinal Profile

5.6.3 Habitat Survey

5.6.4 Survival Plots

5.6.5 Channel and Floodplain Cross-Sections

5.6.6 Fish Passage

5.7 DATA STORAGE AND ANALYSIS

To be completed by the Tribes in a separate document(s).

5.8 MONITORING QUALITY ASSURANCE PLAN

To be completed by the Tribes in a separate document(s).

6 References

Arcement G and V Schneider. 1989. Guide for selecting Manning's Roughness Coefficients for Natural Channels and Flood Plains. United States Geological Survey Water- Supply Paper 2339. Prepared in cooperation with the US Department of Transportation and Federal Highway Administration.

American Society of Civil Engineers (ASCE). 2017. Code of Ethics. First adopted September 2, 1914, most recently amended July 29, 2017.

Confederated Tribes of the Umatilla Indian Reservation (CTUIR). 2014. Lower Walla Walla River Geomorphic Assessment and Action Plan. Prepared by Tetra Tech. 303 pp.

Cramer, Michelle. 2012. Stream Habitat Restoration Guidelines. Copublished by the Washington Departments of Fish and Wildlife, Natural Resources, Transportation and Ecology, Washington State Recreation and Conservation Office, Puget Sound Partnership, and the U.S. Fish and Wildlife Service. Olympia, Washington.

Cramer, Michelle. 2003. Integrated Streambank Protection Guidelines. Published by the Washington State Aquatic Habitat Guidelines Program. Olympia, Washington.

Guillozet, P., K. Smith, K, and K. Guillozet. 2014. The Rapid Riparian Revegetation Approach. Ecological Restoration Vol. 32, No. 2, 2014

Jones K, G Poole, E Quaempts, S O'Daniel, and T Beechie. 2008. Umatilla River Vision. Confederated Tribes of the Umatilla Indian Reservation. Pages 1-31.

Knutson and Fealko. 2014. *Large Woody Material - Risk Based Design Guidelines*. U.S. Department of the Interior Bureau of Reclamation Pacific Northwest Region & Technical Services. Boise, Idaho. September 2014. Online: http://www.usbr.gov/pn//fcrps/documents/lwm.pdf

Mastin, M.C., Konrad, C.P., Veilleux, A.G., and Tecca, A.E., 2016, Magnitude, frequency, and trends of floods at gaged and ungaged sites in Washington, based on data through water year 2014 (ver 1.2, November 2017): U.S. Geological Survey Scientific Investigations Report 2016–5118, 70 p., http://dx.doi.org/10.3133/sir20165118.

Mendel G, Mahoney B, Weldert R, Olsen J, Trump J, and Fitzgerald A. 2014. Walla Walla River Subbasin Salmonid Monitoring and Evaluation Project, 2013 Annual Report. BPA Project # 2000-039-00.

Moyle P. 2002. Salmon and Trout, Salmonidae – Rainbow Trout, (*Oncorhynchus mykiss*) *in* Inland Fishes of California. Los Angeles, California: University of California Press, 271-282.

Moyle P. 2002b. Salmon and Trout, Salmonidae - Chinook Salmon, (Oncorhynchus tshawytscha) in Inland Fishes of California. Los Angeles, California: University of California Press, 251-263.

Quantum Spatial 2018. Washington 3 Counties LiDAR Technical Data Report. Contract No. G16PC00016, Task Order No. G17PD01222. Prepared for USGS NGTOC. October 17, 2018.

Quinn T. 2005. The Behavior and Ecology of Pacific Salmon and Trout. American Fisheries Society in Association with University of Washington Press. Seattle, WA.

United States Army Corps of Engineers. 2022. River Analysis System, HEC-RAS Version 6.2. Approved for Public Release May 2022.

University of Nebraska Press / University of Nebraska-Lincoln Libraries-Electronic Text Center. 2005. The Journals of the Lewis and Clark Expedition. Retrieved November 11, 2022, from http://lewisandclarkjournals.unl.edu/

U.S. Bureau of Reclamation (USBR) and U.S. Army Engineer Research and Development Center (ERDC). 2016. National Large Wood Manual: Assessment, Planning, Design, and Maintenance of Large Wood in Fluvial Ecosystems: Restoring Process, Function, and Structure. 628 pages + Appendix. www.usbr.gov/pn/ January 2016.

U.S. Department of Agriculture (USDA) 1979. Erosion in the Palouse: A Summary of the Palouse River Basin Study. https://archive.org/details/CAT79721859

U.S. Fish and Wildlife Service (USFS). 1995. Working Paper on Restoration Needs: Habitat Restoration Actions to Double Natural Production of Anadromous Fish in the Central Valley of California. Vol 2. Stockton, CA: Prepared for the U.S. Fish and Wildlife Service under the direction of the Anadromous Fish Restoration Program Core Group.

U.S. Geologic Survey (USGS). 1969. Sediment Transport by Streams in the Walla Walla River Basin, Washington and Oregon July 1962-1965. Prepared in cooperation with the Washington State Department of Water Resources and the U.S. Army Corps of Engineers.

U.S. Geologic Survey (USGS). 1998. Soil Erosion in the Palouse River Basin: Indications of Improvement. USGS Fact Sheet 069-98.

WBRPELS 2007. Policy No. 42 Incidental Surveying Practice. Washington Board of Registration for Professional Engineers and Land Surveyors. Adopted July 25, 2007.

7 Appendices

7.1 PROJECT PLAN SHEETS

See accompanying Project Plans: Túuši Wána, Touchet River RM 14-17 | Preliminary Design

7.2 PLANTING PLAN

The planting plan is included in the associated Plan Set (Appendix 7.1) and generally follows the principles outlined Guillozet et al. 2014, with modifications specific to Eastern Washington and the local ecosystem. Quantities of plants are shown on the Plans are for the entire project area and it is expected this will be worked into a phased approach as part of the Final Design submittal. Washington Department of Transportation Standard Specifications have been amended and revised to control plant installations for this particular project, and are shown on the Plans.

7.3 OPINION OF PROBABLE CONSTRUCTION COSTS

See attached opinion of probable construction costs for the work shown on the Project Plan Sheets.

7.4 BID FORM

To be developed in a subsequent design phase.

7.5 HYDRAULICS FIGURES

Accompanying hydraulic model results and sediment mobility figures for existing conditions include:

- Existing Model Results | August Median - 9 cfs
- Existing Model Results | Fish Flows - 750 cfs
- Existing Model Results | 2-Year Event - 2,048 cfs
- Existing Model Results | 25-Year Event - 7,954 cfs
- Existing Model Results | 100-Year Event - 16,850 cfs